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The Relation of the Size
of the Class to School Room Efficiency

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THE RELATION OF THE SIZE OF THE CLASS TO SCHOOL ROOM EFFICIENCY

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THE RELATION OF THE SIZE OF
THE CLASS
TO SCHOOL ROOM EFFICIENCY.

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CHAPTER I.

Introduction.

The present tendency among school administrators to reduce the size of classes is based upon the belief that small classes may be more easily managed and that more satisfactory results can be secured with small classes than with large ones. This belief, however, is not based upon any scientific knowledge of how large or how small a class should be in order to secure the best results. Such knowledge has not been at hand. It is the purpose of this study to determine some of the important facts concerning the relation of the size of classes to schoolroom efficiency.

By the term class, as used throughout this discussion, is meant the group, section, or division taken as the unit for recitation purposes. Only classes in the elementary school are considered, no attempt being made to investigate the problem with reference to high school classes.

Answers to the following questions would be of great importance to the school administrator: - What sized classes are commonly found throughout the grades ? Is there a class of optimum size for purposes of instruction ? If there is, what is it, and does it vary from grade to grade ? Very few attempts have been made to gather data which would help to answer these questions and such data as have been collected are too meager or too limited in their scope to furnish a basis for drawing conclusions which might modify administrative practice. A brief review of these investigations will be sufficient to show the general nature of the conclusions.

Dr. J. M. Rice (1) was perhaps the first to consider the

size of the class as a factor in determining efficiency. A series of problems in arithmetic was given to 6000 pupils in grades four to eight. From these tests he found that schools having large classes tended to rank high as often as did those schools having small classes, and that some of the schools with small classes ranked in the lower group while some of the schools with large classes ranked in the higher group. On the basis of these facts he concludes that the size of the class is not a factor in determining achievement in arithmetic.

In 1909 Dr. O. P. Cornman reported (2) an investigation bearing directly on the problem of the size of classes. He studied 370 classes in the Philadelphia Public Schools, using the percentage of pupils promoted, the percentage of pupils reported by the teacher as doing satisfactory work, and the percentage reported by the teacher as satisfactory in conduct, as standards by which to judge the effect of the size of classes. He drew the following conclusions:-

(1) Size of class is not a very important factor in determining the rate of progress or retardation.

(2) Medium size classes (40 to 49 pupils) make somewhat the best showing.

(3) Large classes (50 or more pupils) make a poorer showing in the primary than in the grammar grades.

Dr. Frank P. Bachman (3) studied the relation of size of class to promotion rate in the New York City Schools. He compared the promotion rates with the size of the classes for a large number of classes. 13% of all pupils were enrolled in classes of 51

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(1) J. M. Rice, Scientific Management in Education, Ch.

(2) O.P.Cornman, The Effect of the Size of Classes on School Progress, Psychological Clinic, Dec. 1909.

(3) Frank P. Bachman, Report of Com. on School Inquiry, Vol.I, Part II.

pupils or more. The promotion rate was found to be somewhat lower in these classes than in the classes with a register of 50 pupils or less. This difference in the promotion rate, however, was so slight that if all classes with an enrollment above 50 were reduced to classes with an enrollment of 50 or less there would be a saving of only one pupil out of every 94 enrolled in classes of 50 or more pupils. Dr. Bachman therefore concludes that the size of the class is a factor of only slight importance in determining the promotion rate.

All of the above mentioned investigations are open to criticism. Dr. Rice studied the problem of the size of class only incidentally and his conclusions are based upon the results of the one test in arithmetic. Dr. Cornman studied only 320 classes in the one school system and he admits that his conclusions need to be verified by more extended investigations. Dr. Bachman's study, although extensive, did not include classes outside the city of New York. Both the Cornman and Bachman studies may represent purely local conditions. Nevertheless all three investigators agree in the important conclusion that the size of the class is not an important factor in securing classroom efficiency. If, however, other measures of achievement had been used and data secured from more widely distributed systems representing greater variety of conditions the above conclusions would be somewhat more reliable.

The present investigation was undertaken, using several measures of efficiency and covering a much more extended area of distribution, with the following purposes in mind:-

(1) To check the results secured in these earlier investigations.

(2) To measure, as accurately as possible, classroom achievement in relation to the size of the class.

(3) To determine, if possible, the size of the group in which the highest general efficiency is secured.

In order to fulfill the purposes stated above it is necessary to use certain standards for measuring classroom achievement. These standards will be discussed in the next chapter.

CHAPTER II.

Standards for judging the achievement of classes.

In order to determine the effect of large classes on classroom achievement it is necessary to use some standards for comparing the achievements of large, medium and small classes. Some of these standards are necessarily crude and somewhat unsatisfactory, nevertheless they are the best now at hand. Others are more or less scientific and can be used with confidence as to their reliability. The standards employed in this study were :-

PROMOTION RATE. The term "promotion rate" is used to designate the percentage of pupils promoted from any class to more advanced classes. The percentage is obtained by dividing the number of pupils promoted by the number of pupils enrolled in the class at promotion time. The promotion rate serves very well as a rough general measure of the efficiency of the work of the schools. In cases where promotions are not made on the basis of merit or achievement or in cases where promotions are forced because of crowded conditions, the promotion rate has very little value as a measure of efficiency. But on the whole the promotion rate may be accepted as a gross measure of general efficiency.

RATE OF WITHDRAWALS. By this term is meant the percentage of pupils permanently withdrawn from any class. The percentage is found by dividing the number of pupils permanently withdrawn from the class during the school year by the total annual class enrollment. This number may be regarded as the number of eliminations from the class although such pupils are not necessarily eliminated from school. It includes withdrawals on account of death or illness, removals from the city, transfers to other buildings, and withdraw-

als for the purpose of going to work. In any case it is only an indirect measure of school efficiency and only when used in connection with other standards, is it to be regarded as significant.

ACHIEVEMENT IN ARITHMETIC AS MEASURED BY THE COURTIS TESTS. The Courtis Tests give some definite standards for comparing large with small classes. If one were to find that small classes in general accomplished more or achieved better results in arithmetic in the same or less time than large classes, one would have an argument for the reduction of the size of classes. Through the kindness of Mr. S. A. Courtis of Detroit, Michigan, the scores of several hundred classes were made available for use in this study.

PERCENTAGE OF PUPILS IN CLASS GIVING ATTENTION TO WORK OF CLASS DURING RECITATION. Attention to the work of the class during a large part of the recitation time is necessary for pupils to get the benefits of the recitation. If a larger percentage of pupils fails to give attention in large classes than in small classes, we may regard the larger classes as the less efficient from the standpoint of instruction. This standard, too, needs to be used with caution because of the difficulty involved in measuring the attention of a class. The method employed in determining the results will be discussed in detail in a later chapter.

PERCENTAGE OF PUPILS ACTIVELY PARTICIPATING IN THE WORK OF THE RECITATION. One of the accepted functions of the recitation is that of giving opportunity to the members of the class to take part in the discussions, to express opinions, to pass judgments, and to reproduce or recall ideas previously gained. If the opportunity to participate in these class activities decreases as the size of the class increases, then the smaller classes may be

regarded as the more efficient unit for purposes of instruction. The determination of the number of pupils in a class not actively participating in the work of the recitation is not a difficult matter, and the method of doing so will be explained later.

THE TIME SPENT BY THE CLASS IN PERFORMING THE VARIOUS MECHANICAL ACTIVITIES OF THE CLASSROOM. The passing of classes to the board or to the front of the room, the getting of books and materials from desks or other sources after intermissions or after recitation periods, or the time required for a class to get ready for dismissal, all serve as indices of the efficiency of the process of habit building, and may be used as bases for comparing large with small classes.

TIME WASTED BY THE STUDY CLASS THROUGH INATTENTION, DISORDER AND LEAVING THE ROOM. From the standpoint of efficiency the time wasted is important. If large classes waste more time than small classes then one may argue, from the efficiency standpoint at least, for a reduction of the size of the class.

A discussion of the methods used, data secured, and results obtained from an application of each of the above mentioned standards is undertaken in the following chapters.

CHAPTER III.

The promotion rate in relation to the size of classes.

In order to secure the data needed in the form necessary for a full determination of the promotion rate, questionnaire blanks were sent out to a random sampling of city superintendents distributed over seven states. These blanks asked for a copy of the promotion records by classes at the close of the school year of 1912-'13. A sample blank is given in Form I which is self-explanatory. Usable returns were secured from 32 school systems in seven different states, distributed as follows; Illinois 16, Indiana 10, Idaho 2, Montana 1, Colorado 1, Alabama 1, and Georgia 1. These cities range in population from 800 to 54,000. 35,581 pupils grouped into 1348 classes are represented in the returns. The records from seven cities could not be used because they were incomplete or the blanks improperly filled out. It will be seen that no very large cities are represented, but this fact probably adds to the reliability of the promotion rate as a measure of efficiency, since in the larger cities promotions are often forced because of inadequate seating conditions and are not made on the basis of merit or achievement of pupils.

The following are possible sources of error in the data:-

(1) Different promotion systems are in use in different cities and the promotion rate as found for one city may not be on the same basis as for other cities. The number of promotions may be given for the half-year in some instances and for the whole year in others, but in any case a <u>class</u> is represented, hence the error is not serious.

(2) Records for extremely large classes in the seventh and eighth

FORM I.

ENROLLMENT-PROMOTION RECORD.

Building.................................... Principal....................................

is here used to designate the group taken as the unit for recitation purposes. It does not mean the number of pupils per teacher
number in the room or grade, except when such a group recites at one time.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
des.	Class is in room with how many other classes?	Number of pupils enrolled in class during 1912-13.	Number pupils permanently withdrawn from class during year 1912-13.	Number remaining in class. (Item 2-item 3.)	Number promoted on condition at end of year 1912-13.	Number passed without condition at end of year 1912-13.	Number failed at end of year 1912-13.
I.							
II.							
I.							
/.							
/.							
I.							
VI.							
I.							

grades were discarded from the data. One superintendent reported 187 pupils enrolled in one eighth grade class. Such cases probably represent classes taught on the department plan hence the promotion rates are not comparable withthose of other classes. Extremely large classes in the lower grades were also not counted for the reason that it was thought that the figures given represented two classes with half-day sessions each.

(3) Classes with extremely low promotion rates were not included. Several cases were reported with 0 promotion rates. These probably represented special classes for the delinquent or defective and such cases should not be compared with normal classes.

In determining the percentage of pupils promoted, those promoted on condition were not included, for the reason that pupils thus promoted have, in most cases, not done satisfactory work. If the promotion rate is to be used as an index of efficiency, questionable cases should be excluded. The promotion rate would have been somewhat higher if conditioned pupils had been included in the class totals.

It would obviously be unfair to base the percentage of promotions on the total class enrollment during the year as that would include withdrawals. The only fair basis is the number of pupils belonging at the end of the year. The formula followed was, -

$$\frac{\text{Number promoted at end of year}}{\text{Number belonging at end of year}} = \text{Promotion rate.}$$

The figures in column 6 of Form I divided by the corresponding figures in column 4 gives the promotion rate.

After determining the percentage of pupils promoted according to the above formula for each of the 1348 classes grade by

grade, these classes were grouped according to the number of pupils enrolled in each class during the year. Nine groups were made as shown in Table I. It will be noted that the groups are in steps of five until the 36-group is reached. Beyond that point the groups are in steps of ten. This change in the grouping was made because the number of classes beyond the 36-group was too few to furnish a reliable average if grouped in steps of five.

TABLE I.
(Showing distribution of classes according to the number of pupils enrolled.)

With an enrollment	No.of classes.	% of total.	Added %.
of,- 10 or less	39	2.9	2.9
from 11 - 15	149	11.1	14.0
" 16 - 20	342	25.4	39.4
" 21 - 26	308	22.8	62.2
" 26 - 30	145	10.7	72.9
" 31 - 35	105	7.8	80.7
" 36 - 45	150	11.1	91.8
" 46 - 55	81	5.9	97.7
" 56 - up.	29	2.3	100.
	1348	100.	

Median class enrollment is 23 pupils.

A glance at the right hand column of the above table shows that nearly three-fourths of all classes have an enrollment of 30 pupils or less, while over four-fifths have an enrollment of 35 or less. These figures clearly show that large classes are not the fashion. They probably indicate also that administrative agencies are already at work to keep class enrollment somewhere below 35 pupils. Dr. Cornman's classes of "medium size" had an enrollment of from 40 to 49 pupils, while Dr. Bachman's smallest group was for classes of 35 pupils or less and only about 11% of all pupils were enrolled in classes of this size. The figures of these two investigations certainly represent conditions of much over-crowding.

Figure I shows graphically the distribution of classes according to size.

The average of the percentages of pupils promoted for each group was next computed, giving the average promotion rate for classes of each size. These averages appear in Table II. This table also shows the number of classes, grade by grade, in each group.

TABLE II.

(Showing promotion rates for classes of each size, grade by grade)

	Grade I.		Grade II.		Grade III.	
Size of class.	No. of classes.	Promotion Rate.	No. of classes.	Promotion Rate.	No. of classes.	Promotion Rate.
10 or less.	3	70.7	7	89.4	4	83.3
11 - 15	20	(88.6)	20	87.9	29	83.5
16 - 20	63	82.0	58	82.7	47	84.9
21 - 25	39	85.5	52	86.3	56	(87.3)
26 - 30	27	78.0	25	85.6	24	80.3
31 - 35	21	74.3	12	88.8	10	79.1
36 - 45	23	79.8	14	83.3	18	87.1
46 - 55	23	79.4	11	(90.6)	11	83.3
56 - up.	8	73.9	6	79.6	3	83.0
Totals,	227	79.1	205	86.0	202	83.5

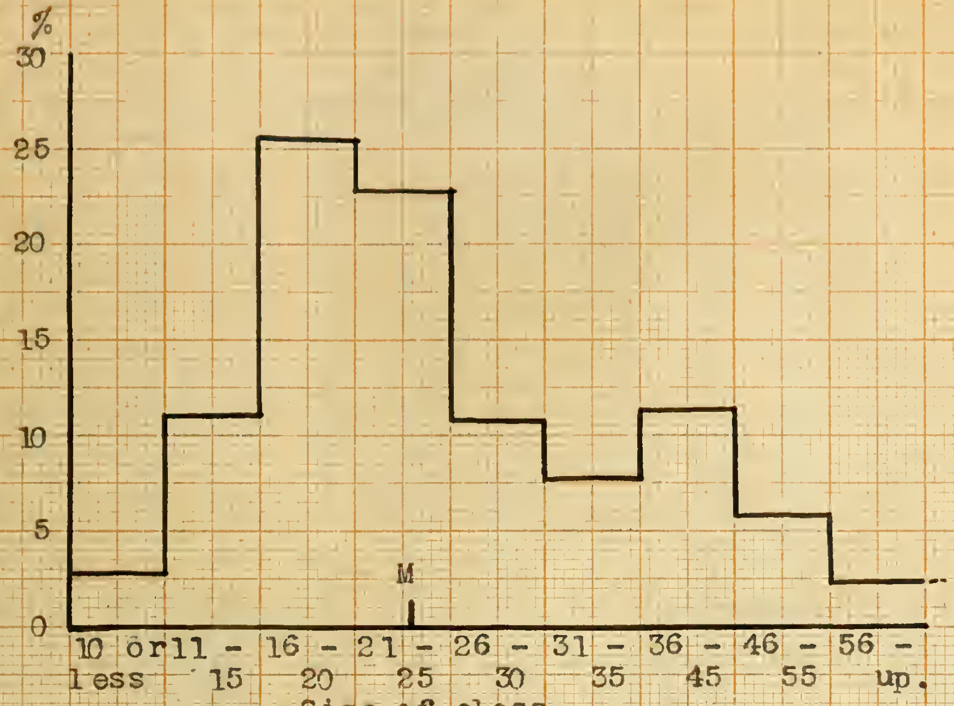
	Grade IV.		Grade V.		Grade VI.	
Size of class.	No. of classes.	Promotion Rate.	No. of classes.	Promotion Rate.	No. of classes.	Promotion Rate.
10 or less.	5	(94.0)	4	(93.2)	5	(88.9)
11 - 15	24	87.8	16	84.4	20	86.1
16 - 20	52	81.0	43	84.4	35	85.3
21 - 25	49	74.9	42	81.6	35	86.2
26 - 30	18	86.1	21	86.0	13	81.7
31 - 35	8	74.6	12	84.1	11	79.4
36 - 45	22	80.0	17	85.5	23	82.7
46 - 55	10	82.8	7	82.1	9	85.3
56 - up.	2	56.5	4	69.8	1	72.0
Totals,	190	79.7	166	83.4	152	83.1

	Grade VII.		Grade VIII.		Total, All Grades.	
Size of class.	No. of classes.	Promotion Rate.	No. of classes.	Promotion Rate.	No. of classes.	Promotion Rate.
10 or less.	7	77.1	4	93.7	39	(86.5)
11 - 15	9	74.9	11	94.1	149	85.5
16 - 20	28	72.1	16	93.2	342	82.7
21 - 25	21	86.3	14	92.6	308	84.2
26 - 30	8	84.0	9	(94.1)	145	83.5
31 - 35	14	78.5	17	92.2	105	81.5
36 - 45	20	(86.6)	13	86.6	150	84.3
46 - 55	7	86.0	3	84.7	81	84.3
56 - up.	1	46.0	4	83.2	29	74.5
Totals,	115	76.8	91	90.5	1348	83.0

Beginning at the top, Table II is to be read, - In Grade I the promotion rate in three classes enrolling 10 pupils or less averages 70.7 %; in Grade II, 89.4 %, etc. The percentages enclosed thus $(\overline{\underline{\qquad}})$ in the above table represent the maximum promotion rate for each grade. If large classes tended to lower the promotion rate the average promotion rates for each grade should decrease as the classes increase in size. Likewise the maximum rates should fall in the smaller class groups and the minimum rates should fall in the larger class groups.

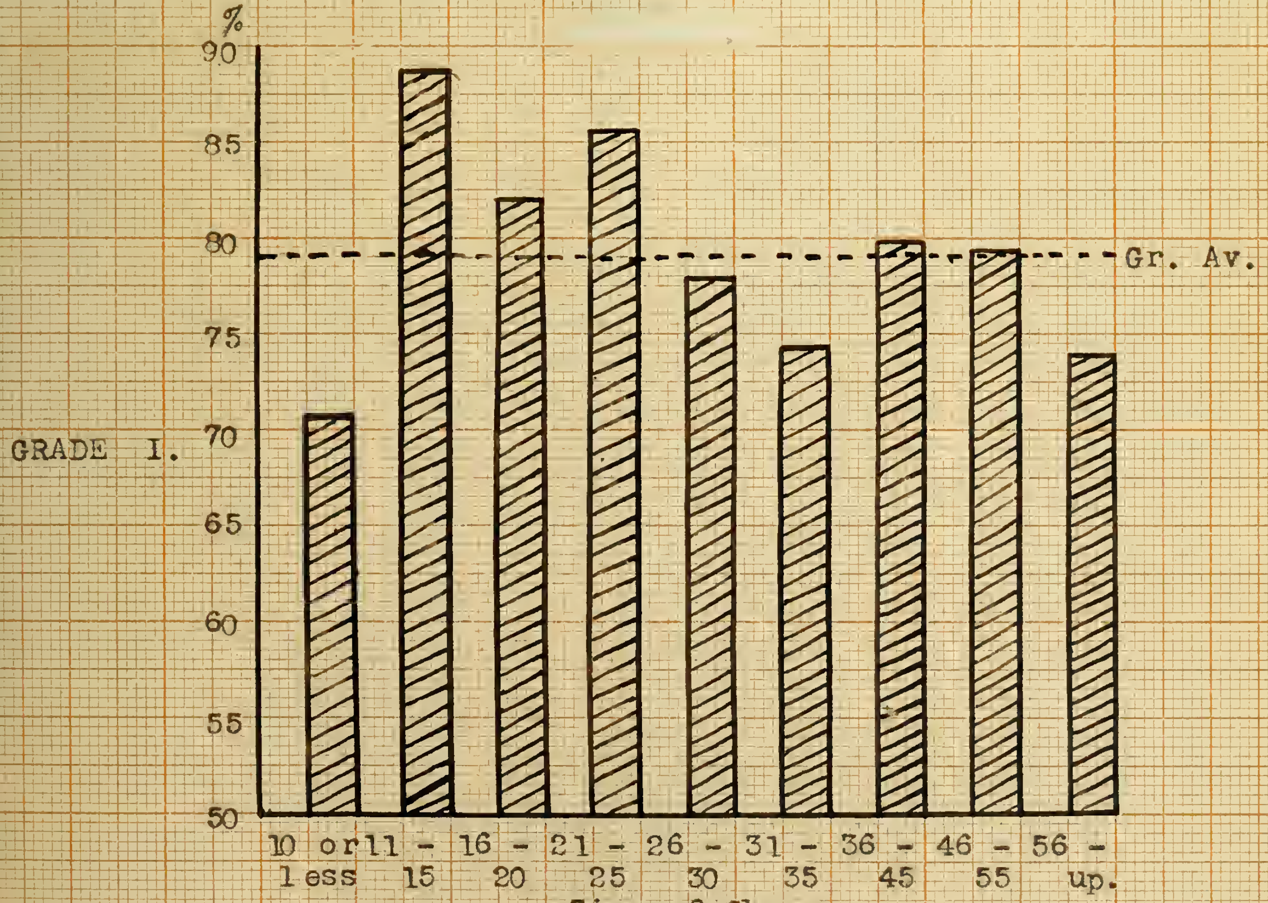
A careful inspection of the figures of Table II reveals the following facts;- (1) In passing from the small class groups to the large ones there is no regular decrease in the promotion rate in any grade. On the contrary, there is in some cases an increase in the promotion rate as the size of the class increases. (2) The maximum promotion rate does not fall uniformly within the smaller class groups, but is found sometimes in the medium and sometimes in the larger class groups. (3) The minimum promotion rate does, with two exceptions however, fall within the larger class groups. (4) In the column of averages for all grades there is a slight, but not regular decrease, as the size of the class increases. In this column, too, the maximum promotion rate falls in the smallest class group and the minimum rate falls in the largest class group.

In order to determine what percentage of pupils would be benefitted by a reduction in the size of classes it is necessary to find the enrollment in each of the class groups. Table III shows this enrollment for each of the grades, the total for all grades, and the percent the enrollment of each class group is of the total enrollment.



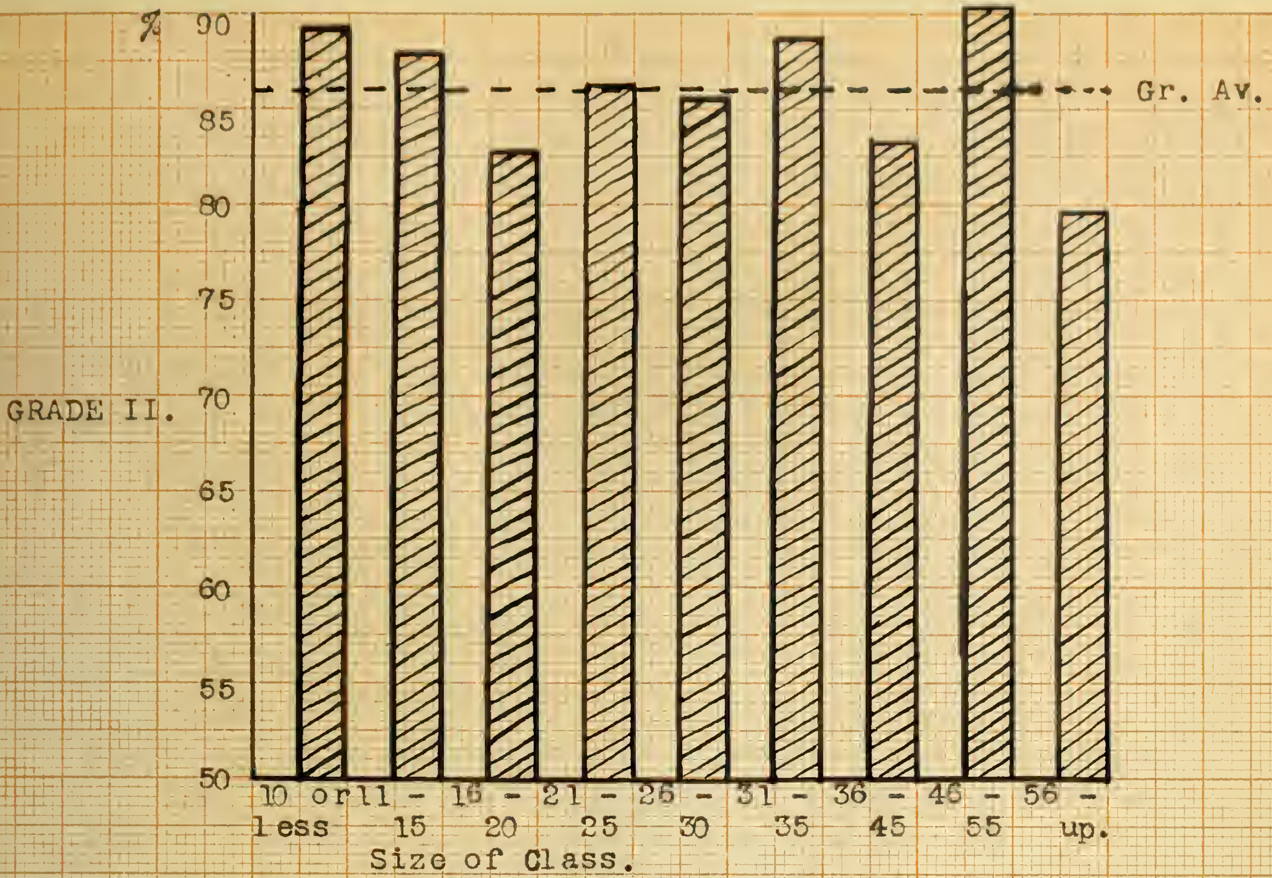
M = Median.

FIGURE I.



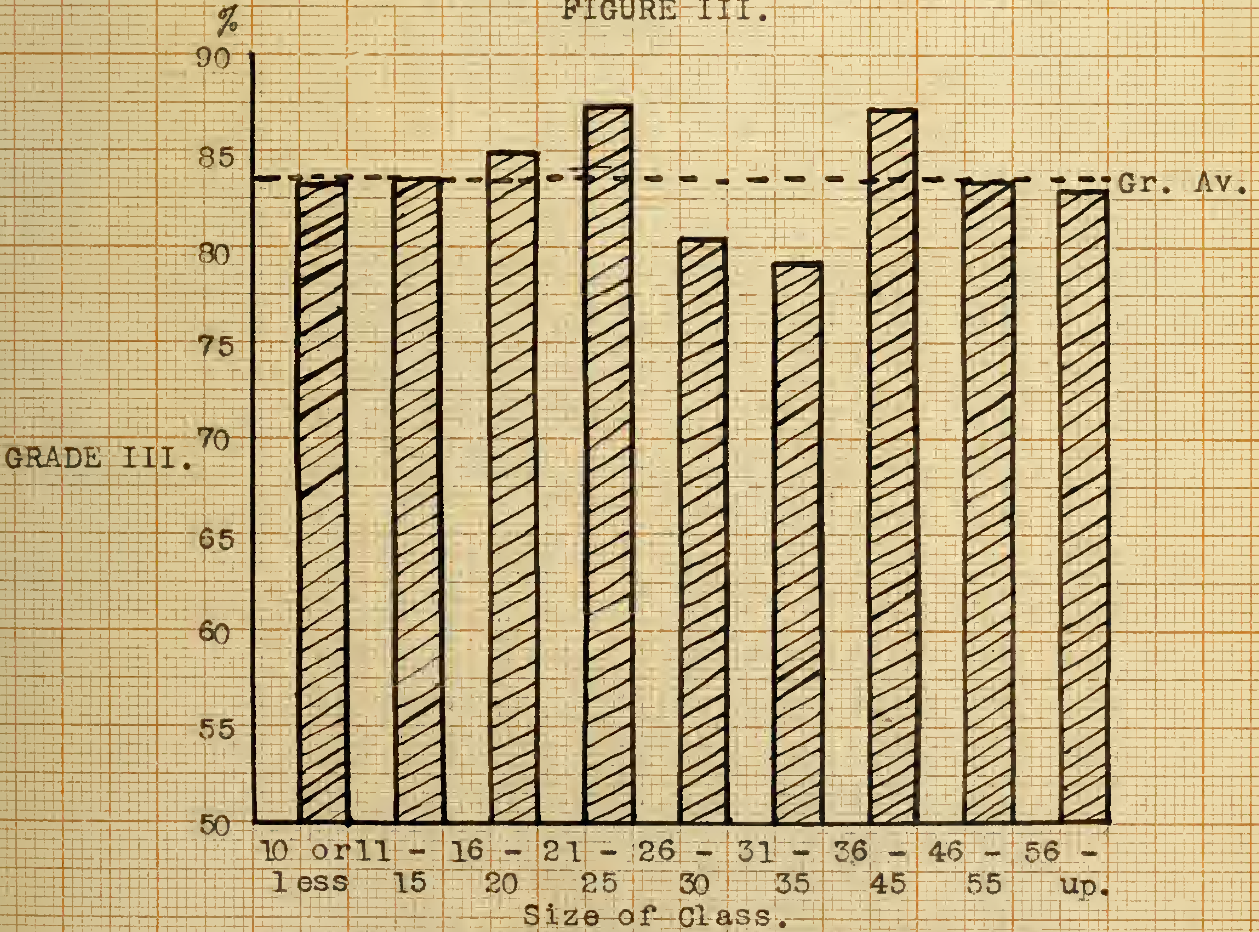
Gr. Av. = Average Promotion Rate for Grade.

FIGURE II.



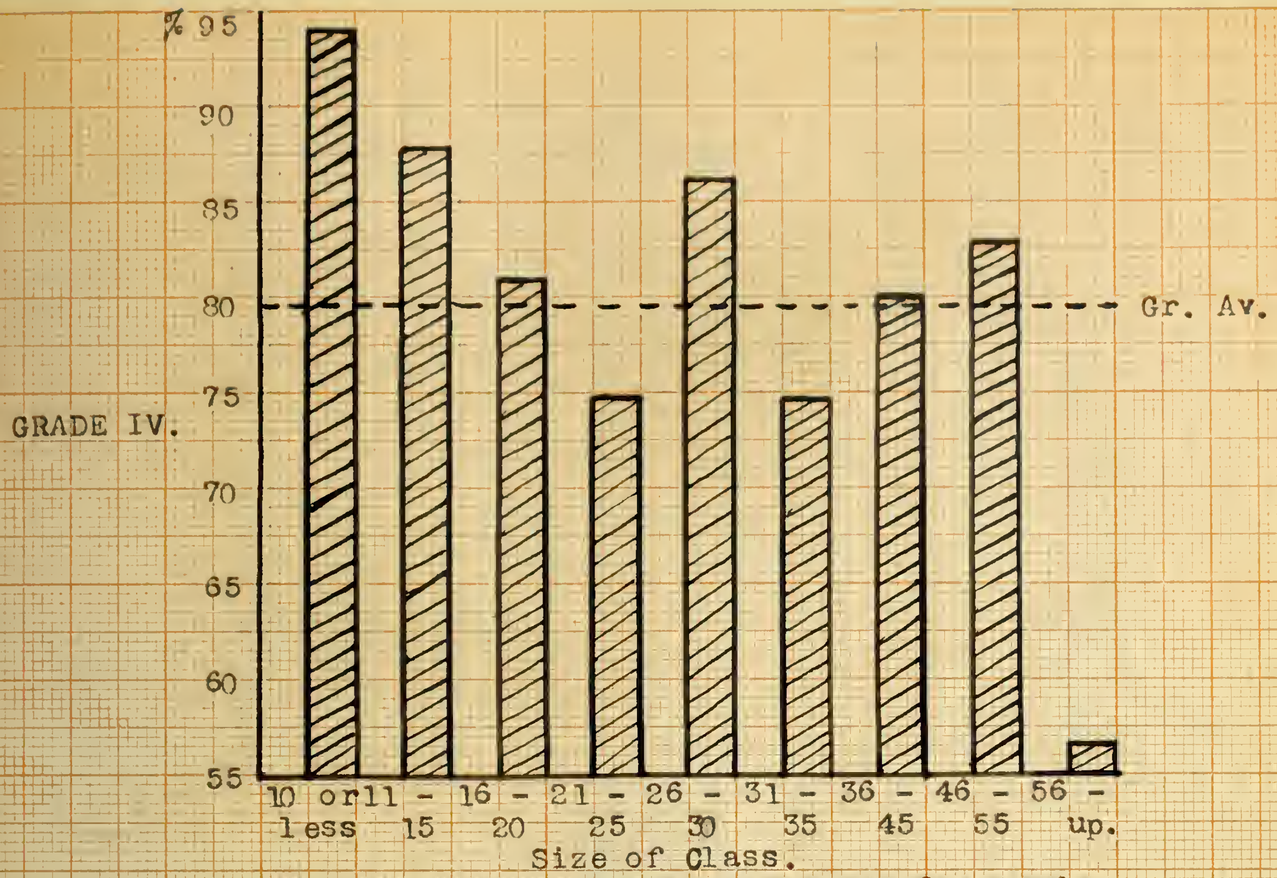
Gr. Av. = Average Promotion Rate for Grade.

FIGURE III.



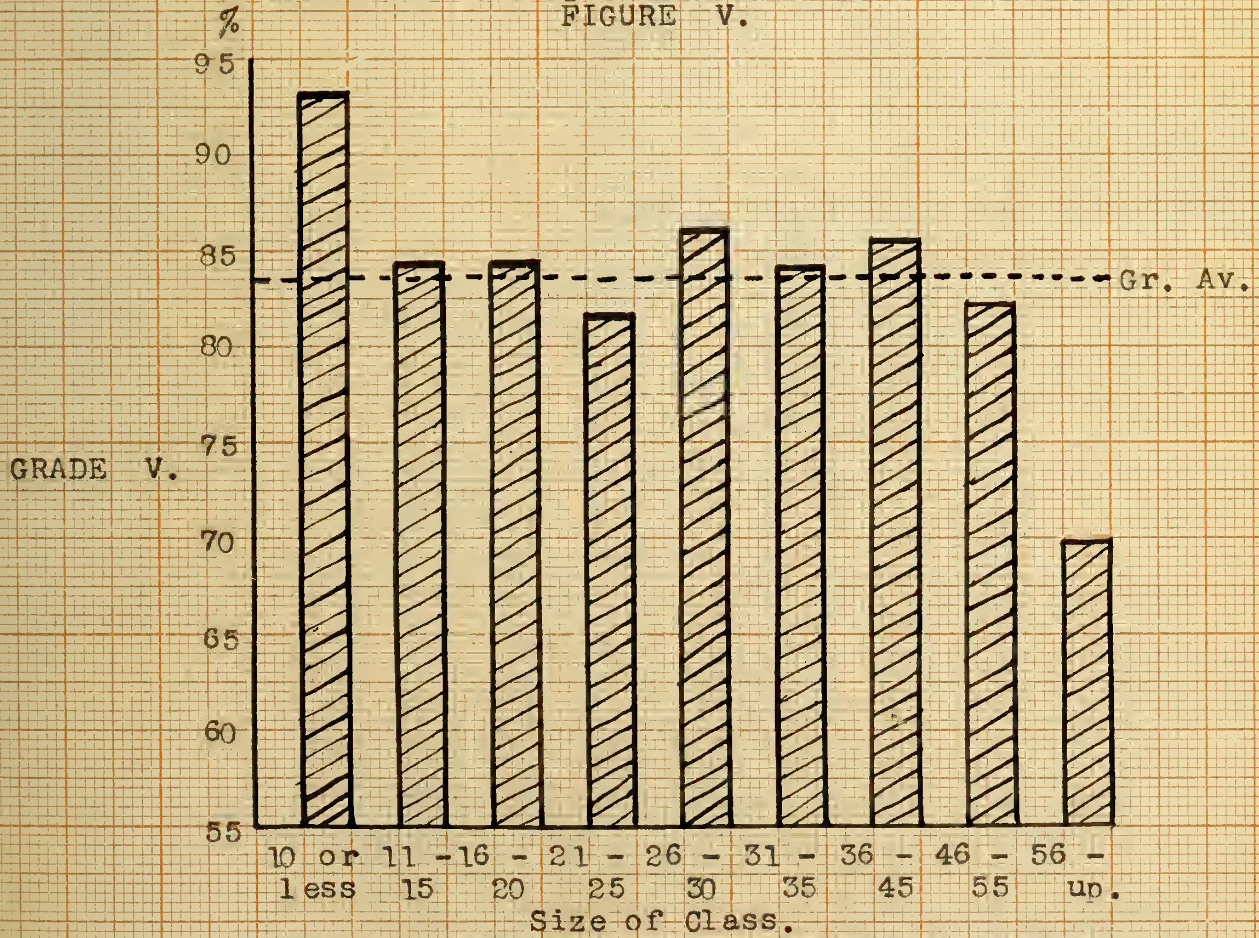
Gr. Av. = Average Promotion Rate for Grade.

FIGURE IV.



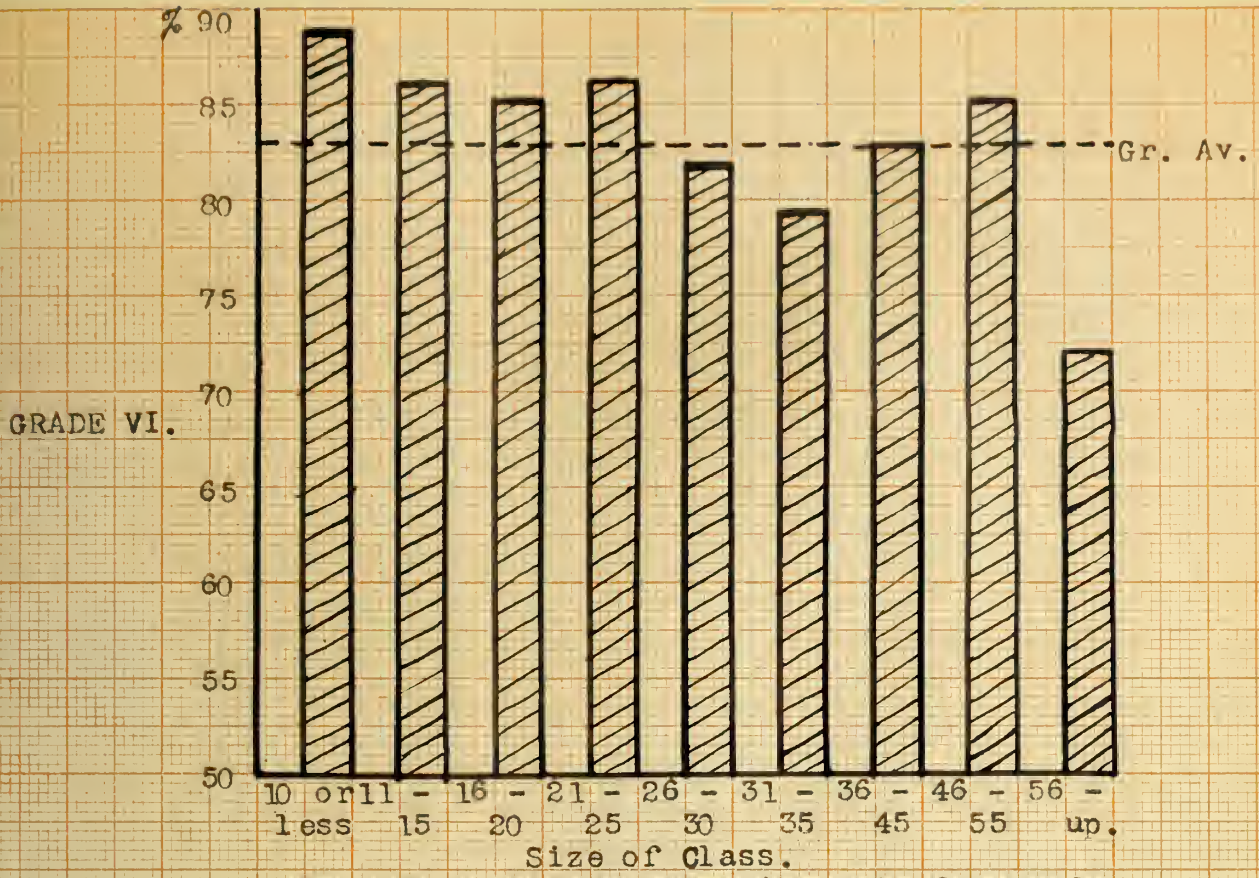
Gr. Av. = Average Promotion Rate for Grade.

FIGURE V.



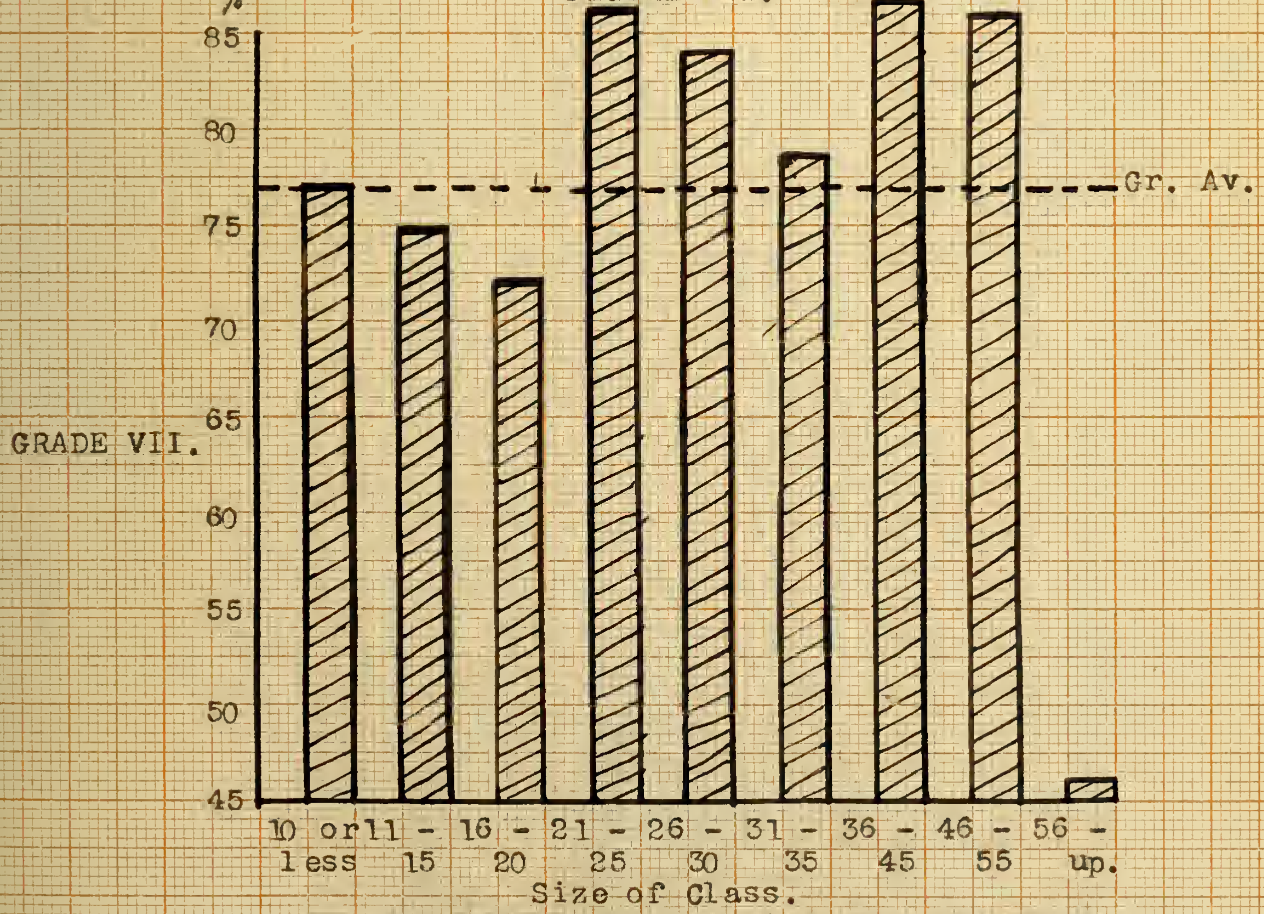
Gr. Av. = Average Promotion Rate for Grade.

FIGURE VI.



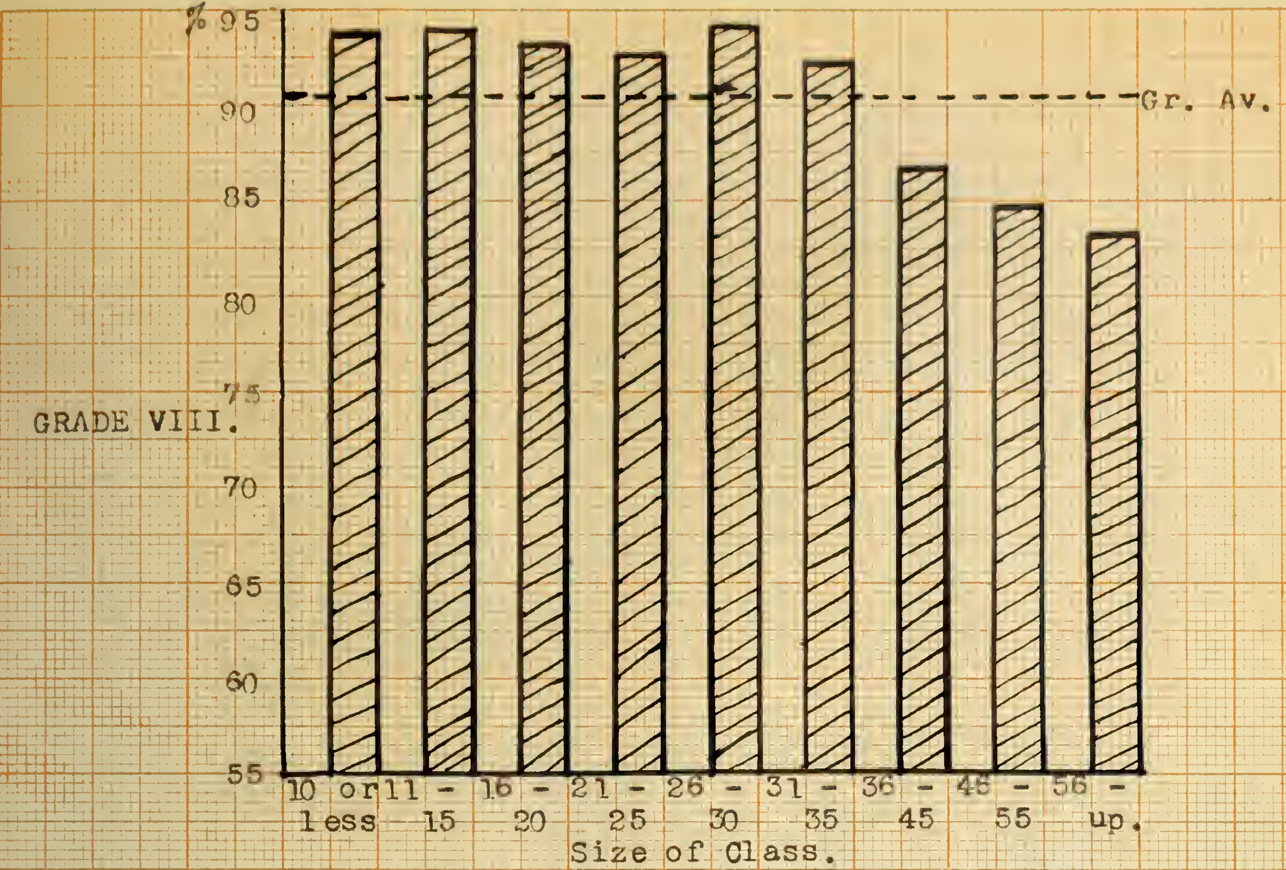
Gr. Av. = Average Promotion Rate for Grade.

FIGURE VII.



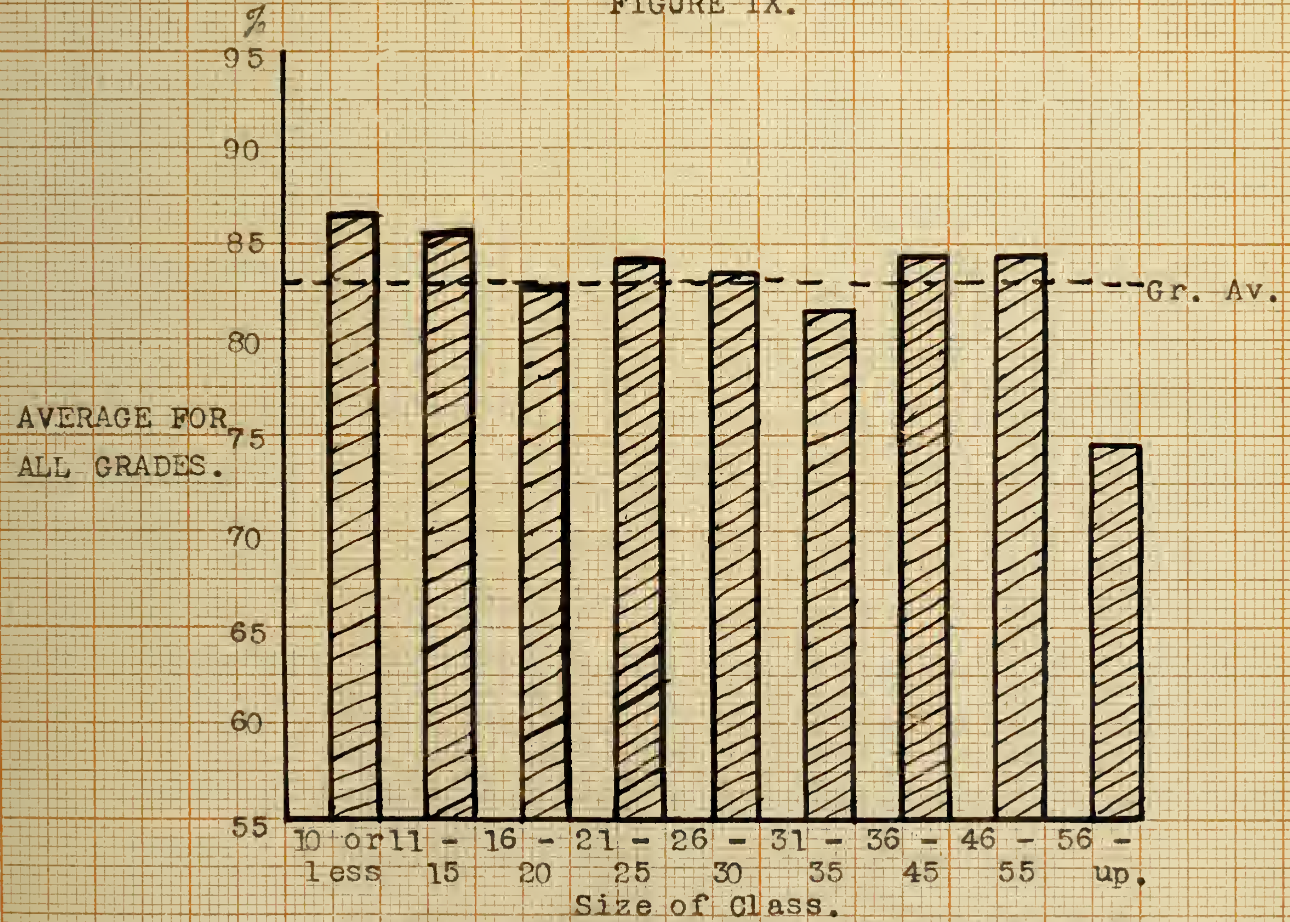
Gr. Av. = Average Promotion Rate for Grade.

FIGURE VIII.



Gr. Av. = Average Promotion Rate for Grade.

FIGURE IX.



Gr. Av. = Average Promotion Rate for All Grades.

FIGURE X.

TABLE III.

(Showing number of pupils enrolled in each class group, grade by grade.)

Size of class.	Grades.					
	I.	II.	III.	IV.	V.	VI.
10 or less	24	62	37	48	40	47
11 - 15	255	261	397	328	198	266
16 - 20	1145	1035	970	935	796	745
21 - 25	962	1218	1310	1157	963	784
26 - 30	668	697	662	505	571	362
31 - 35	753	390	331	255	393	367
36 - 45	937	569	723	901	696	1038
46 - 55	1162	553	549	505	344	434
56 - up.	678	411	173	132	240	57
	6584	5196	5152	4766	4241	4100

Size of class.	VII.	VIII.	Totals, All Grades.	% group is of total.	% added down.	% added up.
10 or less.	62	33	353	.9	.9	100.
11 - 15	122	149	1976	5.5	6.4	99.1
16 - 20	515	290	6431	18.8	25.2	93.6
21 - 25	474	328	7196	20.2	45.4	74.8
26 - 30	227	248	3940	11.1	56.5	54.6
31 - 35	456	560	3505	9.8	66.3	43.5
36 - 45	819	517	6200	17.2	83.5	33.7
46 - 55	344	145	4036	11.2	94.7	16.5
56 - up.	64	181	1936	5.3	100.	5.3
	3083	2451	35573	100.		

Median number of pupils enrolled in classes of 28.

By reading down the next to the last column in the above table one can readily see the percentage of pupils enrolled in all classes with an enrollment less than any class group just above it. By reading up in the last column one can readily see the percentage of pupils enrolled in all classes with an enrollment greater than any class group just below it. The figures in the last column of this table are used in Table IV. The figures in the last column of Table II are also used in deriving Table IV. If the average of all promotion rates above a class of any given size be subtracted from the average of all rates below that sized class, the difference between the two average rates represents the gain in promotion rate

which would result if all classes above a given size were reduced to classes below that given size. These average rates were computed from the figures of the last column of Table II.

Since the enrollment is not equal in all of the class groups we must find what percent the gain in promotion rate for each group is of the total group enrollment, in order to determine the actual gain to be secured by a reduction in the size of classes. The results of the above mentioned computations are given in Table IV.

TABLE IV.

(Showing the saving in promotions per 1000 pupils which would result from a reduction in the size of classes.)

Size of class.	Ave.Prom. rate for all classes below.	Ave.Prom. rate for all classes above.	Difference in rates above and below.	Pupils per 1000 enrolled in groups above.	Saving in promotions per 1000 pupils enrolled in each group.
55 or less	84.1	74.5	9.6	53	5
45 " "	84.0	79.4	4.6	165	8
35 " "	84.0	81.0	3.0	337	10
30 " "	84.5	81.1	3.4	435	15
25 " "	84.7	81.6	3.1	546	17
20 " "	84.9	82.1	2.8	748	21
15 " "	86.0	82.1	3.9	936	37
10 " "	86.5	82.6	3.9	991	39

This table becomes clear when read,- If all classes with an enrollment above 55 pupils were reduced to classes of 55 or less, 5 more pupils per 1000 would be promoted; if all classes above 45 were reduced to classes of 45 or less, 8 more pupils per 1000 would be promoted, etc. The column at the right shows a slight increase in the number promoted as the size of the class is reduced. The saving thus secured, however, is very small in comparison with the increased cost that would attend the administrative adjustments demanded by a reduction in the size of classes. Such changes would mean more rooms and equipment and more teachers. And under crowd-

ed conditions, where most of the large classes are found, new buildings would be required. No doubt the same or greater gain in the number of pupils promoted could be secured much more economically through improved methods of teaching and more skillful management of the larger classes.

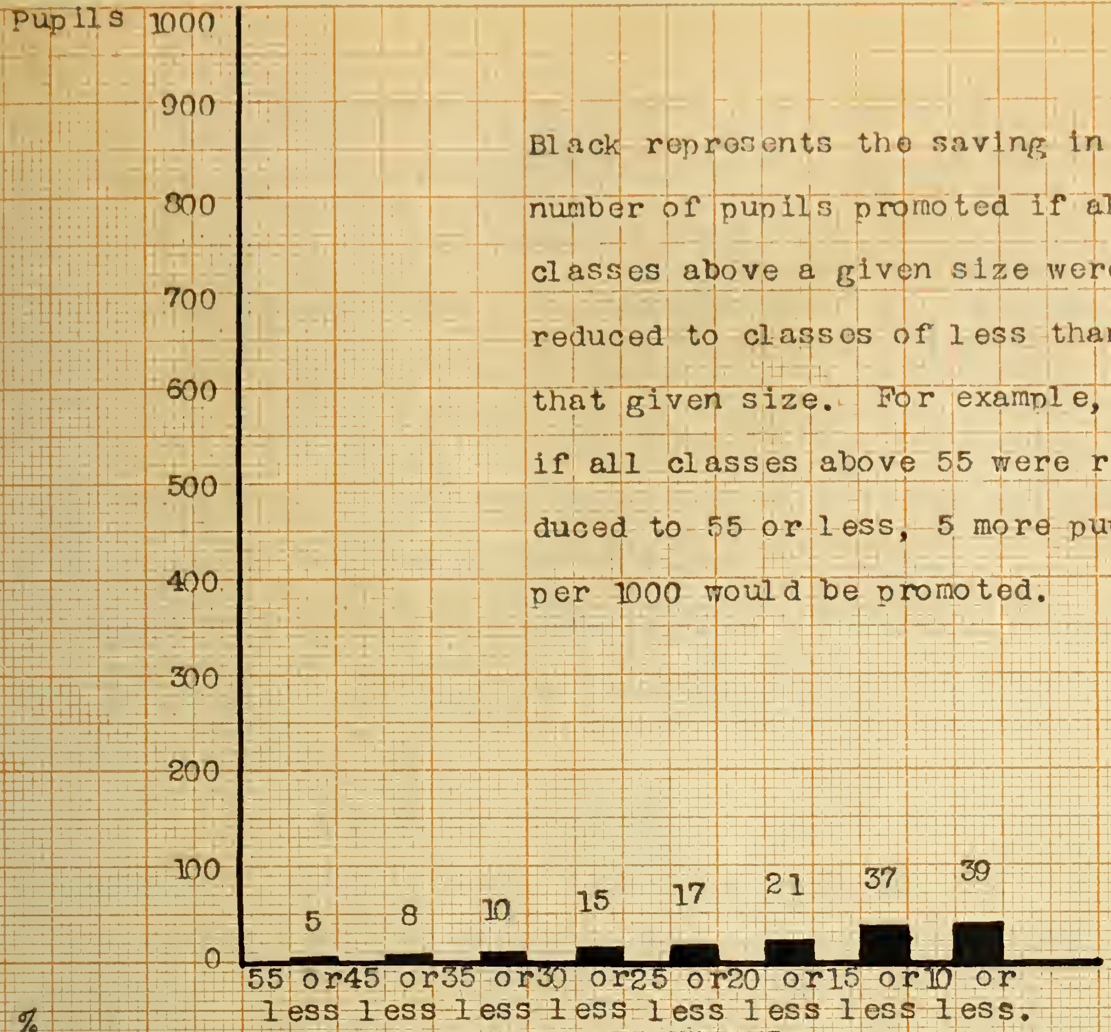
Figure XI shows graphically the saving in promotions as given in Table IV.

Dr. Cornman (1) claimed that large classes made a poorer showing in the Primary Grades than in the Grammar Grades and, therefore, that large classes were more harmful in the lower grades than in the upper grades. If this were true, it should appear when the Primary, Intermediate, and Grammar Grades are compared group by group. This comparison is made in Table V. Grades I, II, and III are included under Primary; Grades IV, V, and VI, under Intermediate; and Grades VII and VIII, under Grammar.

TABLE V.
(Showing promotion rates for each sized class for each of the school divisions.)

	Primary.		Intermediate.		Grammar.	
Size of class.	No. of classes.	Prom. rate.	No. of classes.	Prom. rate.	No. of classes.	Prom. rate.
10 or less.	14	81.1	14	92.2	11	85.4
11 - 15	69	86.7	60	86.1	20	83.5
16 - 20	168	83.2	130	83.6	44	82.7
21 - 25	147	86.4	126	80.9	35	89.5
26 - 30	76	81.3	52	84.6	17	89.0
31 - 35	43	80.7	31	79.4	31	85.4
36 - 45	55	83.4	62	82.4	33	86.6
46 - 55	45	84.4	26	83.4	10	86.6
56 - up.	17	78.8	7	66.1	5	64.6
	634	82.9	508	82.1	206	83.7

This table should be read,- In the Primary Grades in 14 classes with an enrollment of 10 pupils or less the promotion rate averages 81.1%; in the Intermediate Grades, 92.2%; etc. Figure XII makes a graphic comparison of the figures of Table V.



Black represents the saving in the number of pupils promoted if all classes above a given size were reduced to classes of less than that given size. For example, if all classes above 55 were reduced to 55 or less, 5 more pupils per 1000 would be promoted.

FIGURE XI.

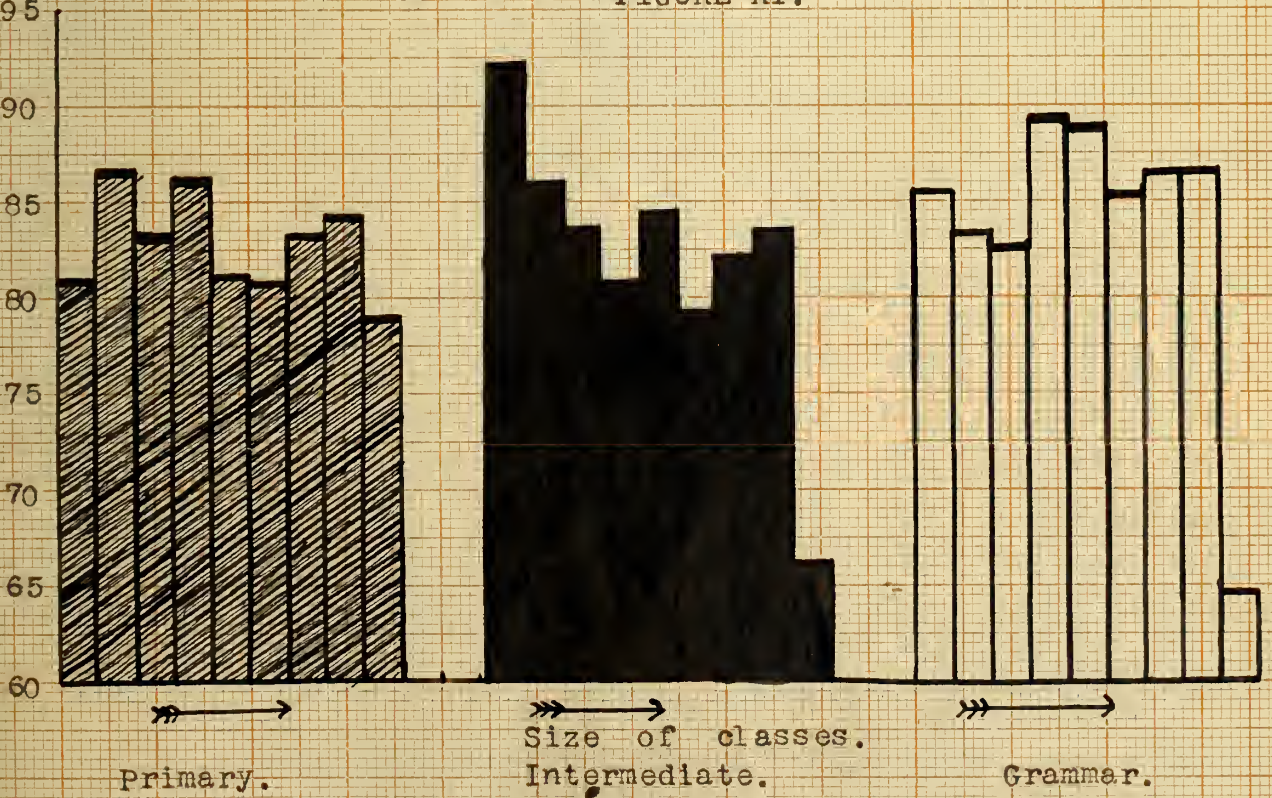


FIGURE XII.

The following facts are apparent in the above table:-

(1) As the size of the class increases, the decrease in the promotion rate is no more rapid in the lower than in the upper grades.

(2) In the Primary Grades the promotion rate in the group for classes above 55 is higher than in either of the other school divisions.

(3) The most marked decrease in the promotion rate is in the Intermediate Grades. Perhaps this dropping of the average promotion rate is due to the congestion of backward children in these grades.

(4) Apparently there is no more regular decrease in the promotion rate for the school divisions than for each of the grades when taken separately.

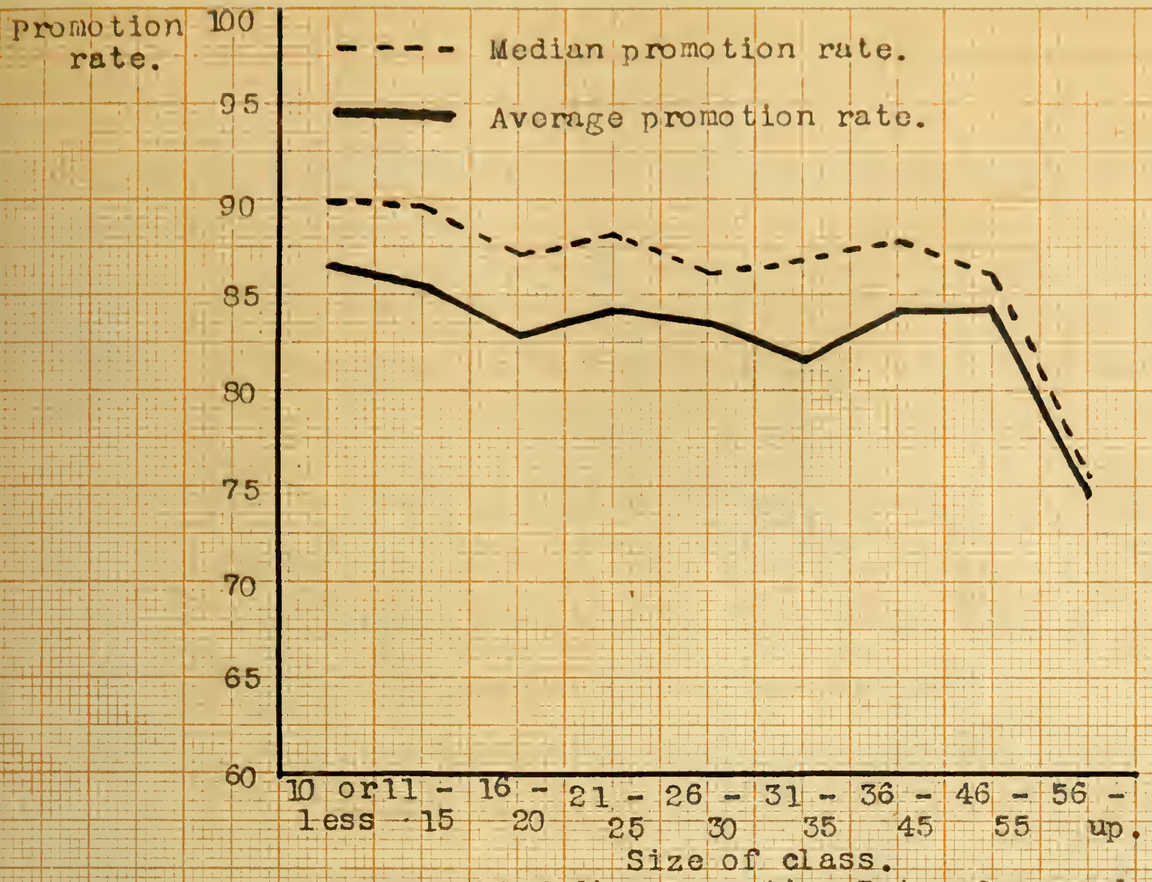
For those who would question the use of the average in all the previous determinations, it may be said that the median was also computed for each grade and for all grades and that the difference was so slight that it was deemed unnecessary to give the results in terms of both the median and the average. The median in every case was somewhat higher but shows the same tendencies to fluctuation as the average. The two measures are compared in Table VI.

TABLE VI.

(Comparison of average with median promotion rates for all grades.)

Size of class.	Average, all grades.	Median, all grades.
10 or less.	86.5	90.0
11 - 15	85.5	89.7
16 - 20	82.7	87.1
21 - 25	84.2	88.1
26 - 30	83.5	86.1
31 - 35	81.5	86.9
36 - 45	84.3	87.6
46 - 55	84.3	86.0
56 - up.	74.5	75.5
	83.0	86.6

Figure XIII is a graphic representation of the above figures.



Average and Median Promotion Rates Compared.

FIGURE XIII.

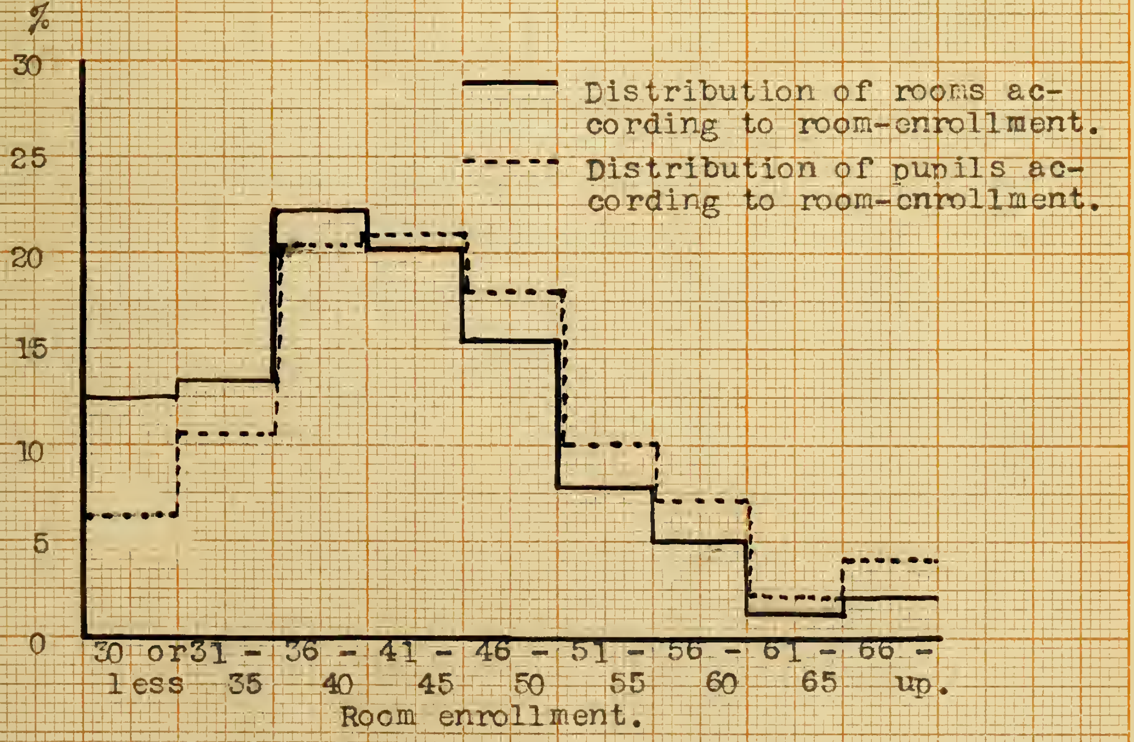


FIGURE XIV.

Conclusions.

The facts of Tables I to V may be summarized in the following conclusions:-

(1) Fifty percent of all classes have a small enrollment, (23 pupils or less.) Fifty percent of all pupils are enrolled in classes of 28 pupils or less.

(2) The maximum promotion rate for all grades is in classes enrolling 10 pupils or less. This rate varies for the different grades, but in all except Grades II and VII it falls in classes of 30 pupils or less.

(3) There is apparently a slight direct relationship between the promotion rate and the size of the class. This relationship is sufficient to produce a saving in promotions of from 5 to 39 pupils per thousand, provided all large classes could be reduced to small classes.

(4) The effect of the size of class on the promotion rate is not more apparent in the Primary Grades than in the Grammar Grades, but is slightly more apparent in the Intermediate Grades than in either of the other departments or divisions of the school.

(5) The evidence of the effect of the size of the class on the promotion rate, though slight, is in favor of small classes.

CHAPTER IV.

The relation of the number of pupils per room and the number of classes in a room to the promotion rate.

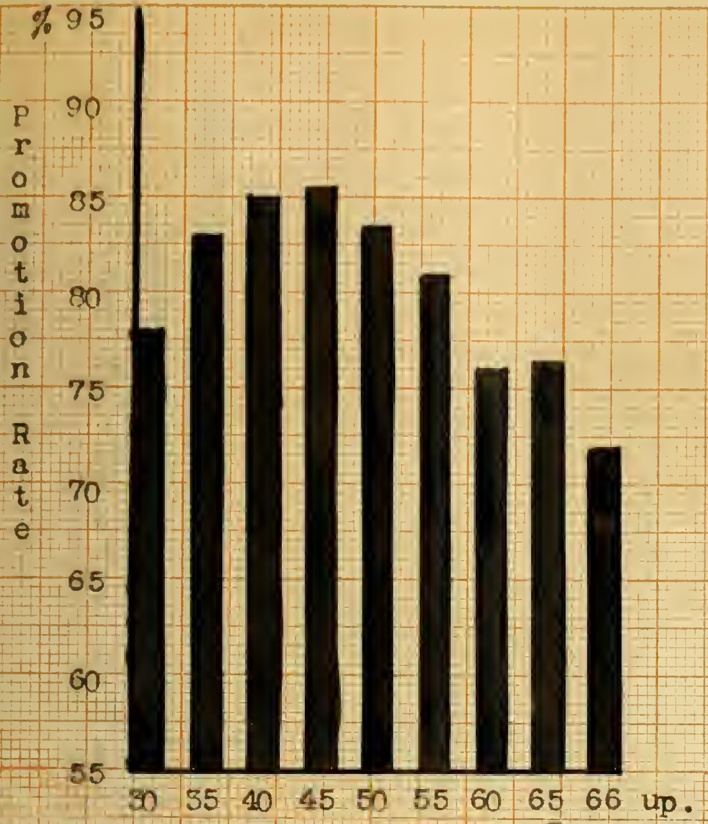
It was shown in Chapter III that the size of the class is a factor of only slight importance in determining the promotion rate. There are other groupings of pupils, however, besides that of the class which might in some way affect the promotion rate. The number of pupils in a room, under one teacher, and the number of classes or sections in a room, may both affect the percentage of pupils promoted. Data descriptive of these conditions were collected along with those relating to the size of classes.

The 30,985 pupils studied were seated in 751 rooms. In some rooms the pupils were grouped into three sections, in others into only two sections, and in still others into one section. In cases where there were two or three sections in a room, often two and sometimes three grades were represented. These groupings offer opportunities for comparing the promotion rates under the conditions named above. The following tables show the comparisons thus made.

TABLE VII.

(Showing number of pupils per room and promotion rates.)

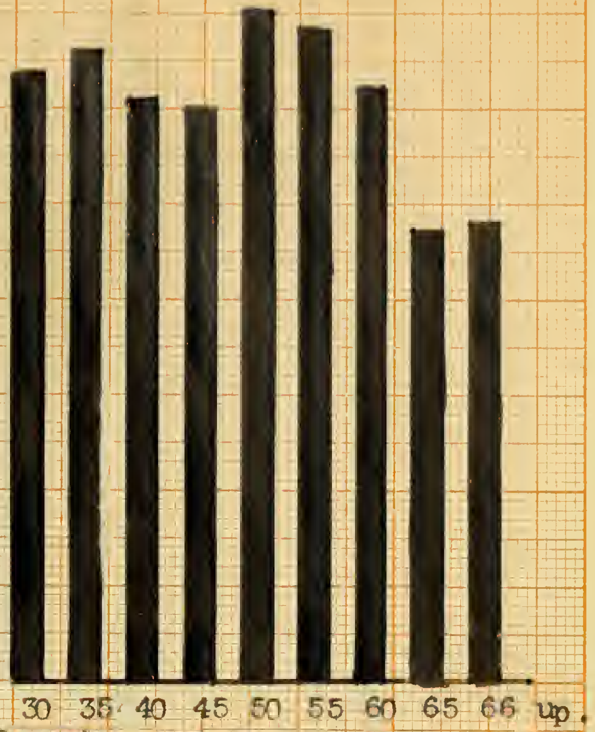
	Grades.							
	I.		II.		III.		IV.	
Room enrollment.	No. of rooms.	Prom. rate.	No. of rooms.	Prom. rate.	No. of rooms.	Prom. rate.	No. of rooms.	Prom. rate.
30 or less.	4	78.0	15	86.7	11	83.8	13	85.2
31 - 35	11	83.0	17	88.0	10	84.6	14	(87.7)
36 - 40	31	85.0	21	85.4	22	86.0	17	85.2
41 - 45	23	(85.4)	22	85.2	29	82.6	19	87.1
46 - 50	25	83.3	14	(90.2)	17	(87.2)	20	83.4
51 - 55	16	80.9	8	88.1	11	79.2	7	81.5
56 - 60	11	76.0	4	86.1	5	82.8	5	66.9
61 - 65	6	76.4	3	78.5	0		0	
66 - up.	8	71.9	2	79.	3	84.9	3	58.2
	135	80.0	106	85.2	108	83.9	98	79.4



Grade I.

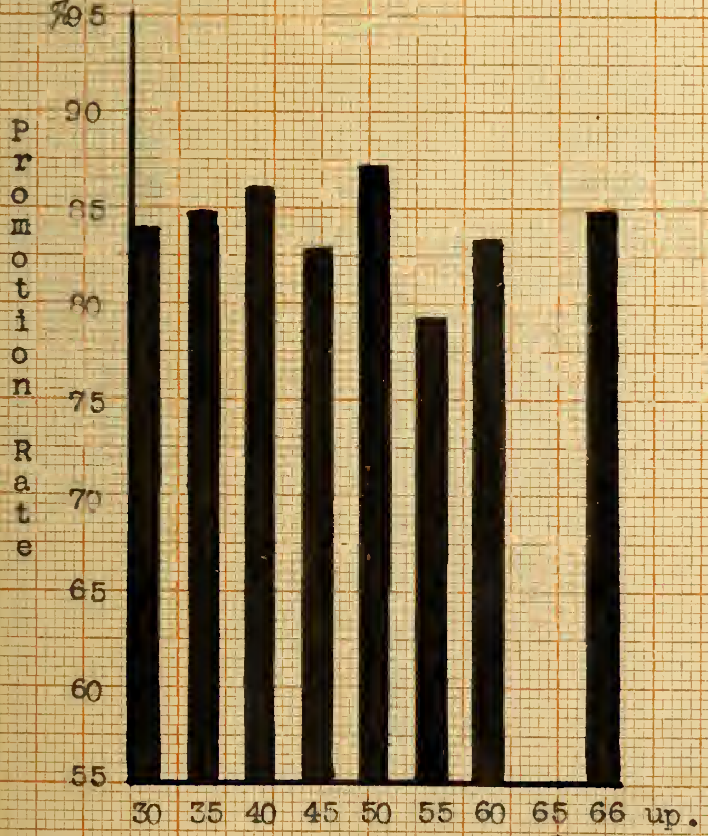
FIGURE XV.

Room enrollment.



Grade II.

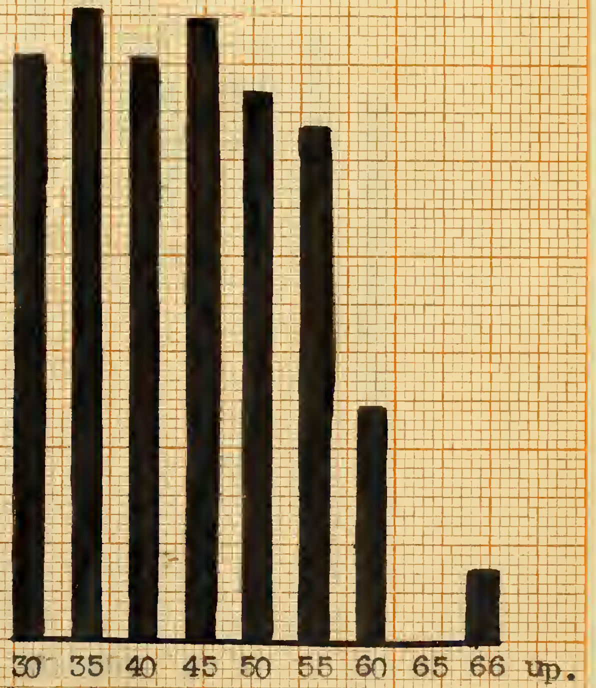
FIGURE XVI.



Grade III.

FIGURE XVII.

Room enrollment.



Grade IV.

FIGURE XVIII.

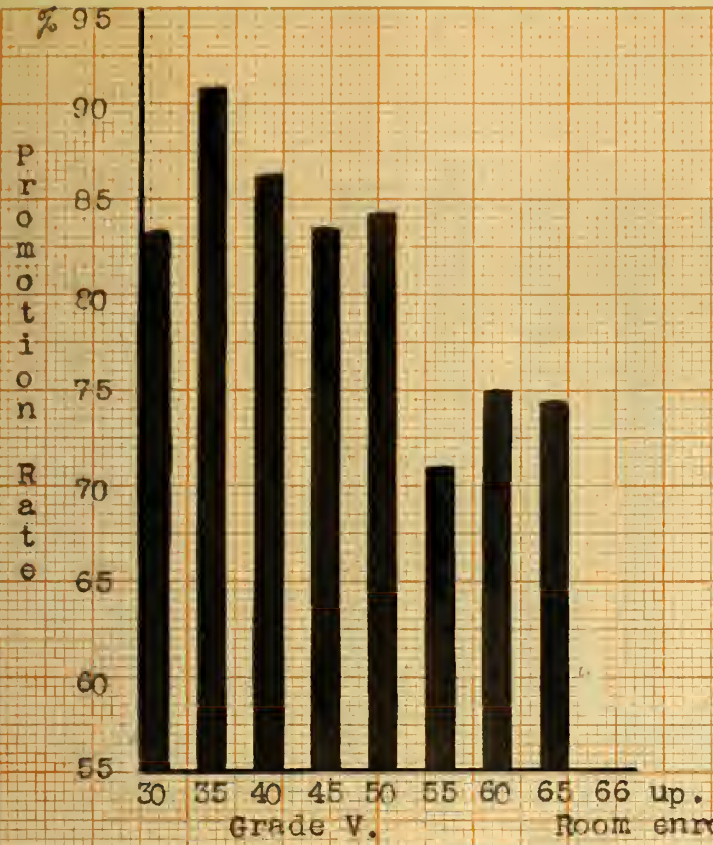


FIGURE XIX.

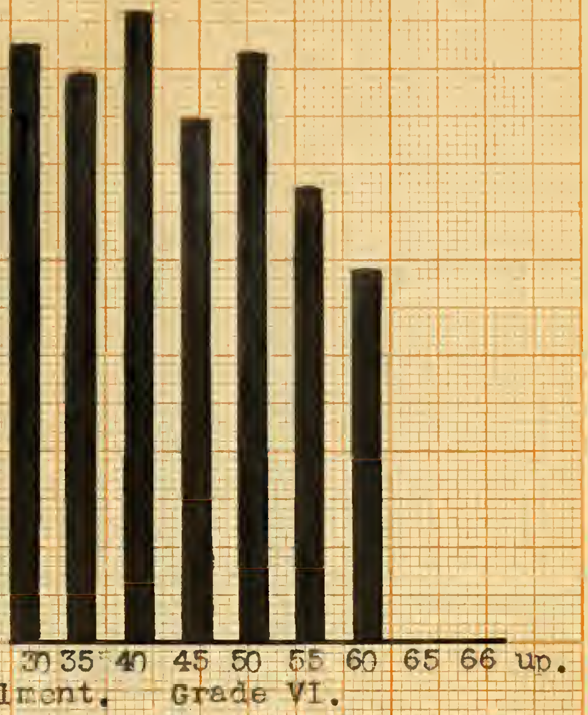


FIGURE XX.

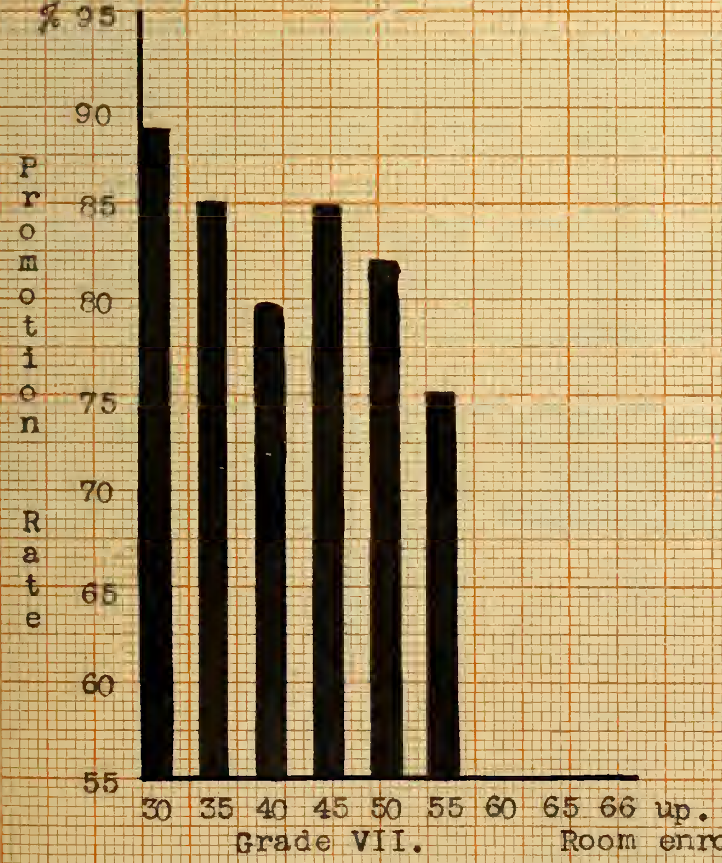


FIGURE XXI.

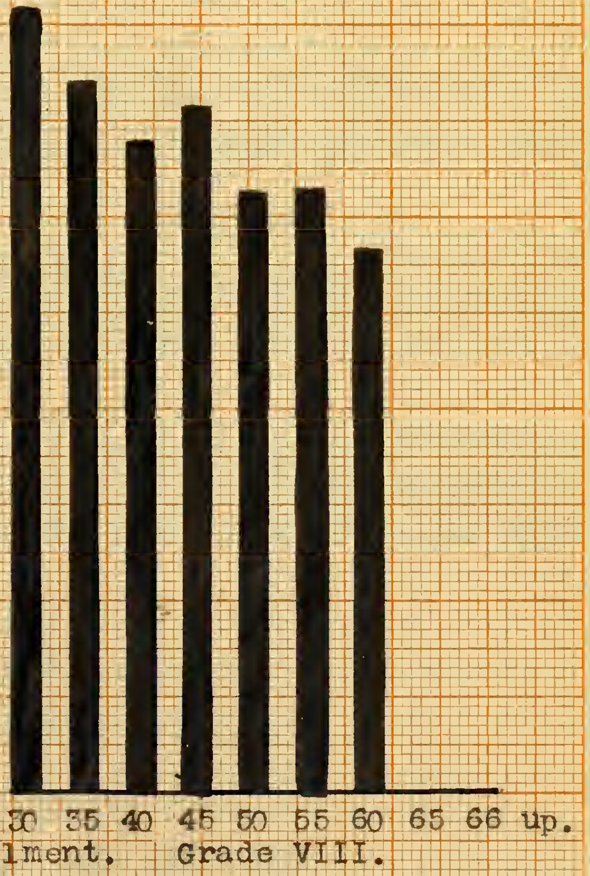


FIGURE XXII.

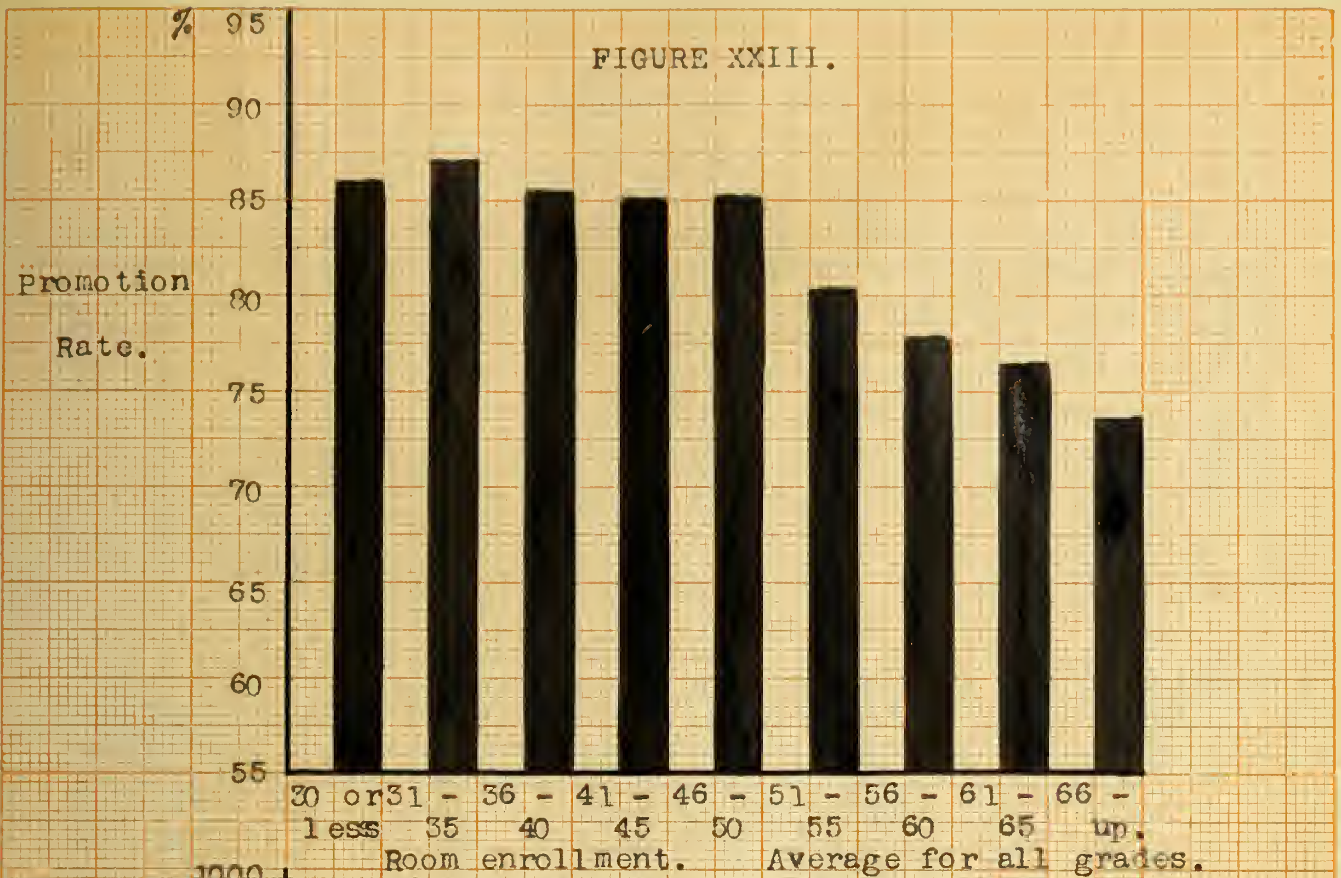
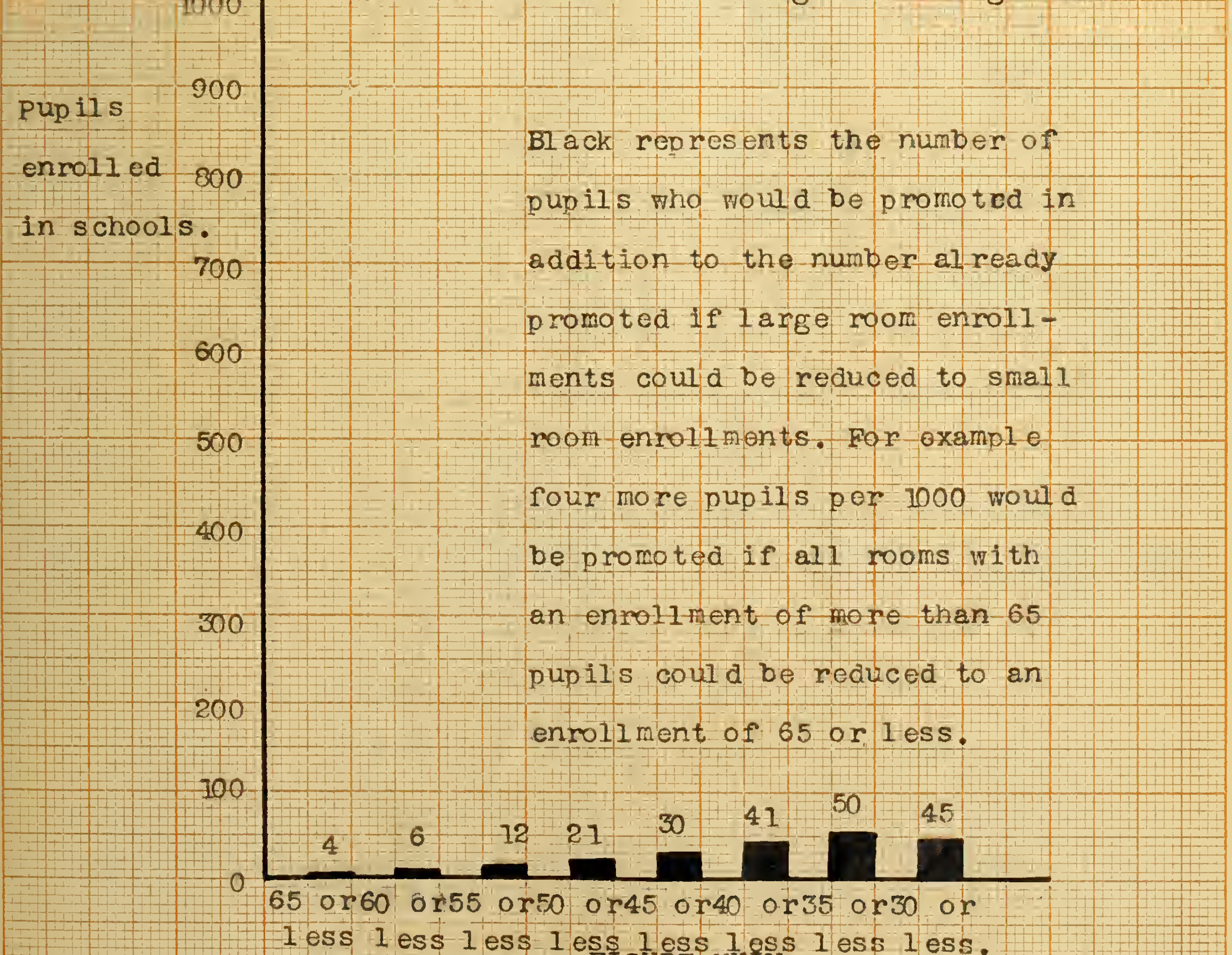


FIGURE XXIII.



Black represents the number of pupils who would be promoted in addition to the number already promoted if large room enrollments could be reduced to small room enrollments. For example four more pupils per 1000 would be promoted if all rooms with an enrollment of more than 65 pupils could be reduced to an enrollment of 65 or less.

FIGURE XXIV.

TABLE VII. (Cont.)

	Grades.							
	V.		VI.		VII.		VIII.	
Room enrollment.	No. of rooms.	Prom. rate.	No. of rooms.	Prom. rate.	No. of rooms.	Prom. rate.	No. of rooms.	Prom. rate.
30 or less.	9	83.2	13	86.2	10	(88.7)	19	(95.3)
31 - 35	12	(90.7)	8	84.7	15	85.0	13	91.9
36 - 40	24	86.1	30	(88.0)	12	79.5	9	88.8
41 - 45	16	83.4	19	82.3	18	84.9	6	90.6
46 - 50	16	84.1	10	85.6	10	81.7	5	86.1
51 - 55	5	70.9	4	78.8	4	75.7	3	86.4
56 - 60	4	75.0	4	74.4	0		4	83.2
61 - 65	2	74.2	0		0		0	
66 - up.	0		0		0		0	
	88	80.9	88	82.8	69	82.6	59	88.8

	Total, all grades.			
Room enrollment.	No. of rooms.	Prom. rate.	% of all rooms in each group.	Added % group by group.
30 or less.	94	86.0	12.5	12.5
31 - 35	100	(87.0)	13.4	25.9
36 - 40	166	85.5	22.1	48.0
41 - 45	152	85.2	20.1	68.1
46 - 50	117	85.2	15.5	83.6
51 - 55	58	80.2	7.9	91.5
56 - 60	37	77.7	5.0	96.5
61 - 65	11	76.4	1.4	97.9
66 - up.	16	73.5	2.1	100.
	751	81.9	100.	

Median number of pupils per room = 40.

Beginning at the top this table should be read, - In Grade I in four rooms with an enrollment of 30 pupils or less the average promotion rate is 78%; in Grade II, 86.7%; etc. The figures enclosed thus (_____) represent the maximum promotion rates for each grade. (See also Figures XIV to XXIII.)

It will be noted, (1) That in all grades and in the totals the maximum promotion rates fall in groups with a room-enrollment of less than 50 pupils, and that in all except Grades I, II, and III the highest rate falls in groups with an enrollment of less than 40 pupils. (2) There is a somewhat regular decrease in the promotion rate as the room-enrollment increases. This is true not only for each of the grades but for the totals for all grades. (3) 50%

of all rooms have an enrollment of 40 pupils or less.

The third from last column in Table VII shows a decrease in the promotion rate as the size of the room-enrollment increases, but it does not show how many more pupils would be promoted if the room enrollment should be decreased. In order to determine this it is necessary to find the number of pupils enrolled in each room-enrollment group. These figures together with the percentage which each group is of the total enrollment are given in Table VIII.

TABLE VIII.
(Showing total number of pupils enrolled in each room-enrollment group.)

Room-enrollment groups.	No. of rooms.	Total No. of pupils in each group.	% each group is of the total.	% added down.	% added up.
30 pupils or less.	94	1966	6.4	6.4	100
31 - 35	100	3297	10.6	17.0	93.6
36 - 40	166	6321	20.4	37.4	83.0
41 - 45	152	6515	21.0	58.4	62.6
46 - 50	117	5594	18.0	76.4	41.6
51 - 55	58	3094	10.0	86.4	23.6
56 - 60	37	2210	7.2	93.6	13.6
61 - 65	11	686	2.2	95.8	6.4
66 - up.	16	1302	4.2	100.	4.2
	751	30985	100.		

Median number of pupils enrolled in rooms enrolling 44 pupils.

The above table should be read, - The total number of pupils enrolled in 94 rooms of 30 pupils or less is 1966 or 6.4% of all pupils; in 100 rooms of from 31 to 35 pupils, 3297 or 10.6%; etc. The cumulative percentages are given in the last two columns.

From the average promotion rates for all grades in rooms of different room-enrollments, as given in the third from last column of Table VII, one can compute the averages for all rooms above a given enrollment and for all rooms below a given enrollment. These averages are given in the first and second columns of Table IX.

The gain in the promotion rate which would result from a reduction of the room enrollment may then be found by subtracting the average rate for all rooms above a given enrollment from the average rate for all rooms below a given enrollment. The differences are given in the third column of Table IX. The next to last column gives the number of pupils per thousand enrolled in all groups above any group of given size. These figures were obtained from the last column of Table VIII. The figures of the next to last column of Table IX multiplied by the corresponding figures of the column to the left of it gives the figures of the last column. This column represents the saving in the number of pupils promoted if the enrollment in rooms above any given room-enrollment could be reduced to room-enrollments below that given size.

TABLE IX.
(Showing the gain in number of pupils promoted resulting from a reduction in the room-enrollment.)

If the room-enrollment were reduced to,-	Ave. Prom. rate above.	Ave. Prom. rate below.	Gain in Prom. rate.	Pupils per 1000 enrolled in groups above.	Saving in pupils per 1000 promoted.
65 or less	83.0	73.5	9.5	42	4
60 " "	83.8	75.0	8.8	64	6
55 " "	85.0	75.9	9.1	136	12
50 " "	85.8	76.9	8.9	236	21
45 " "	85.9	78.6	7.3	416	30
40 " "	86.2	79.7	6.5	626	41
35 " "	86.5	80.5	6.0	830	50
30 " "	86.0	81.2	4.8	936	45

Figure XXIV shows graphically this saving in promotions.

The figures of the last column in the above table become significant when interpreted thus,- If the number of pupils in all rooms with an enrollment of more than 65 were reduced to an enrollment of 65 pupils or less, 4 more pupils out of every 1000 would be promoted; if the room-enrollment were reduced to 60 or less, 6 more pupils would be promoted; etc.

Both the rapid decrease in the promotion rate as the room-enrollment increases, and the rapid increase in the saving of promotions resulting from a reduction of the room-enrollment, are facts of importance. These facts justify the conclusion that the number of pupils per teacher or the room-enrollment is a somewhat more important factor in determining the promotion rate than is the size of the class. How is this conclusion to be explained?

In a large percentage of the cases there are two or more classes in a room, one reciting while the other is studying. The attention of the teacher is really divided between the two classes. Her attention to individuals is distributed over the whole room. Hence the actual unit for instruction is the room and not the class. If the number of pupils in the room is large the energies of the teacher are more diffused and the amount of individual help she can give is greatly diminished, consequently her work is likely to be less efficient than it would be if there were fewer pupils in the room. These explanations suggest the following questions;-

(1) How many pupils should there be in a room under one teacher?

(2) Is it better to have one, two or three sections or classes in a room?

(3) Is it better to have separate classes of one grade or of mixed grades in a room?

The first of these questions has already been answered in the last column of Table IX. It was there shown that the greatest saving in promotions occurs in classes of 35 pupils or less. The other questions will be answered by Tables X and XI. See also Figures XXV and XXVI.

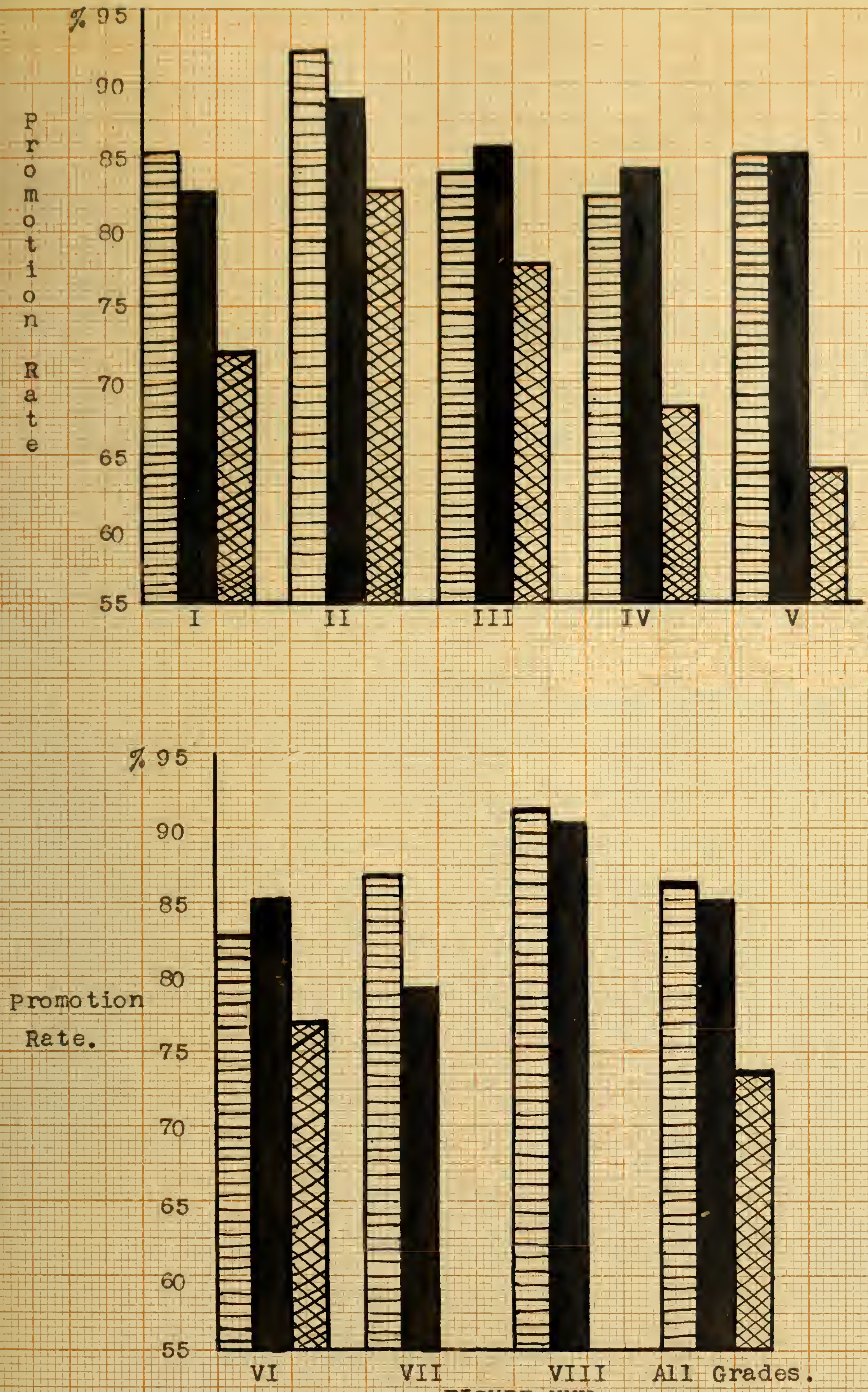


FIGURE XXV.

▤ Rooms containing one section.

■ Rooms containing two sections.

▩ Rooms containing three sectns.

TABLE X.

(Showing promotion rates in rooms containing one, two or three sections.)

	Grades.							
	I.		II.		III.		IV.	
No. of sections in a room.	No. of rooms.	Prom. rate.	No. of rooms.	Prom. rate.	No. of rooms.	Prom. rate.	No. of rooms.	Prom. rate.
One.	31	85.3	33	92.1	36	84.0	30	82.4
Two.	90	82.6	69	88.9	65	85.7	66	84.2
Three.	14	71.8	4	82.8	7	77.8	2	68.3
	135	79.9	106	87.9	108	82.2	98	78.3
	V.		VI.		VII.		VIII.	
One.	38	85.1	40	82.7	40	86.7	46	91.3
Two.	49	85.1	44	85.2	29	79.2	13	90.0
Three.	1	64.0	4	77.0	0		0	
	88	78.1	88	81.6	69	83.0	59	90.7

	Total, all grades.		% total, all rooms.	Added %.
One.	294	86.2	39.1	39.1
Two.	425	85.1	56.6	95.7
Three.	32	73.6	4.3	100.
	751	81.6	100.	

The above table should be read,- In Grade I in 31 rooms of one section each the promotion rate averages 85.3%; in Grade II, 92.1%; etc. It will be seen that, with three exceptions, the rooms having only one section or class have the highest promotion rates. The average for all grades shows a decrease in the promotion rate as the number of classes in a room increases. Rooms with three sections have a much lower rate than those with either one or two sections. It should also be noted that over half of all the rooms have two sections or classes.

The evidence of the above facts is strongly against the division of pupils of a room into three sections, and is slightly in favor of one section as compared with two sections to a room. This conclusion is easily explained. The one-section pupils probably do better because the study periods are made to alternate with the recitation periods, and during the study period the teacher may give her whole attention to supervising the study of her pupils.

This can not be the case where there are two or three sections since one class must be reciting while the other is studying. Then too, in the rooms with only one section there are fewer recitation periods per day consequently those periods are of longer duration. This is likewise true for the study periods for the one-section rooms. Still another fact which seems to favor the one-section rooms is, that the distracting influence of the recitation class is not present in the one-section rooms during the study period.

It is impossible, however, to have the pupils of a room grouped into one section when two or more grades are represented in the room. Table XI shows the effect on the promotion rate of having sections of two or more grades in one room. In this table sections of Grade II and sometimes Grade III are included under Grade I when sections of these grades are seated in the same room with the First Grade. Likewise some sections of Grade III were included in Grade II. In all cases of "mixed" rooms the grade just above was included.

TABLE XI.
(Showing the effect on the promotion rate of mixed grades in a room)

	I.		II.		III.		IV.	
	No. of rooms.	Prom. rate.	No. of rooms.	Prom. rate.	No. of rooms.	Prom. rate.	No. of rooms.	Prom. rate.
Mixed grades.	24	83.1	16	88.1	23	82.4	19	82.6
Unmixed "	111	81.9	90	86.1	85	84.5	79	89.2
	135	82.5	106	87.1	108	83.5	98	85.9

	V.		VI.		VII.		VIII.	
Mixed grades.	10	84.8	8	83.7	6	82.9	(6	82.9)
Unmixed "	78	83.8	80	83.7	63	83.7	59	87.6
	88	84.3	88	83.7	69	83.3	59	84.7

Total, all grades.

	No. rooms.	Prom. rate.	% total, all rooms.
Mixed grades.	106	83.8	14.1
Unmixed "	645	85.1	85.9
	751	84.4	100.

In Grade VIII the figures enclosed thus (____) have already been counted in Grade VII hence are not included in the totals.

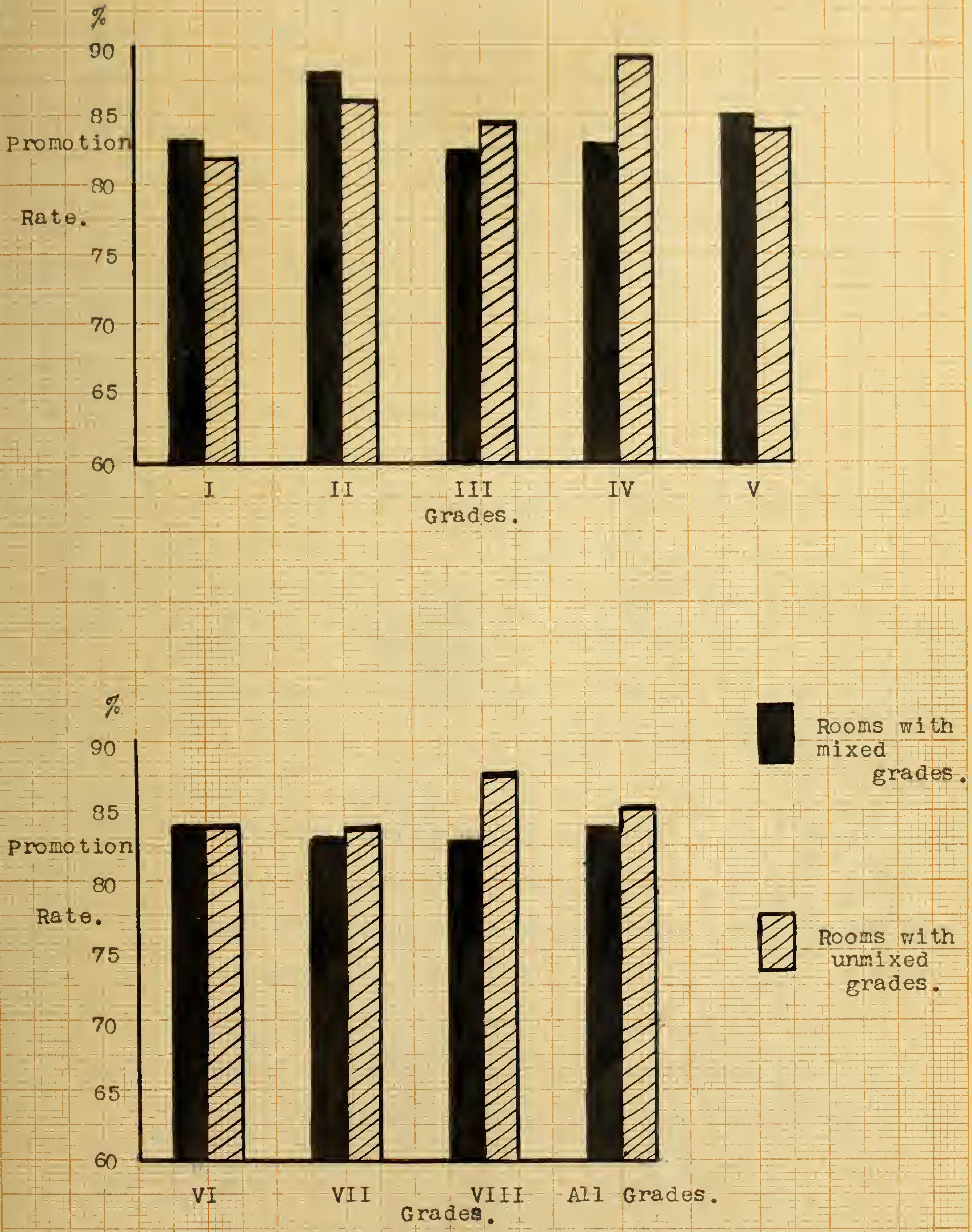

%
90
85
Promotion
80
Rate.
75
70
65
60
I
II
III
IV
V
Grades.
%
90
85
Promotion
80
Rate.
75
70
65
60
VI
VII
VIII
All Grades.
Grades.
Rooms with mixed grades.
Rooms with unmixed grades.

FIGURE XXVI.

Table XI becomes clear when read,- In Grade I in 24 rooms containing sections of Grades I and II the promotion rate averages 83.1%; in Grade II in 16 rooms containing sections of Grades II and III the promotion rate averages 88.1%; etc.

The averages for all grades in Table XI show a difference of 1.2% in the promotion rates of mixed and unmixed grades in favor of unmixed grades. This difference is only slight however, and perhaps is not significant, since in three instances it favors mixed grades.

In reviewing the figures of Tables VII, VIII, IX, X, and XI the following facts are evident:-

(1) The highest promotion rate is found in rooms enrolling 35 pupils or less.

(2) There is a rapid falling off of the promotion rate in rooms with an enrollment of 50 or more pupils.

(3) The greatest saving in pupils promoted is to be secured by a reduction of the room-enrollment to 35 pupils or less.

(4) The highest promotion rate is found in rooms where there is no grouping of pupils into separate classes or sections. Rooms with three sections have a very low average promotion rate.

(5) As measured by the promotion rate, there is a slight tendency for rooms enrolling pupils of one grade only to do somewhat better than those enrolling pupils of two or more grades.

CHAPTER V.

The number of pupils permanently withdrawn during the year from classes of different sizes.

It is difficult to prove the existence of a causal relationship between the size of the class and the number of pupils permanently withdrawn or dropped from the class. Nevertheless such a relationship may exist. We at least, have evidence from the records of 1348 classes that the percentage of pupils withdrawn from large classes is much greater than the percentage of pupils withdrawn from small classes.

The data from which the facts of this chapter are drawn were collected at the same time and on the same blanks as those for the class enrollment and the promotion rate. (See Form I) The number of classes and the methods of computing the percentages are the same as those used in Table II. The base, however, in this case is the total class enrollment for the year. Table XII gives the percentage of withdrawals from classes of different sizes.

TABLE XII.

(Showing the percentage of pupils permanently withdrawn from classes of different sizes during the year.)

	Grades.				
	I	II	III	IV	V
Size of classes.	% of withdrawals.	% of withdrawals.	% of withdrawals.	% of withdrawals.	% of withdrls.
10 or less.	(7.7)	(8.6)	(2.8)	16.4	17.5
11 - 15	14.3	8.8	10.6	(9.3)	11.6
16 - 20	14.2	9.3	12.5	11.4	(9.8)
21 - 25	14.5	14.1	11.8	11.3	13.2
26 - 30	17.8	14.8	13.3	14.8	13.1
31 - 35	18.6	14.8	12.5	10.5	16.2
36 - 45	18.7	19.8	8.6	12.9	15.5
46 - 55	22.4	14.8	18.5	13.5	15.2
56 - up.	24.0	17.5	14.0	28.9	15.8
	16.9	13.6	11.6	14.3	14.2

TABLE XII (Cont.)

Size of classes.	VI % of withdrawals.	VII % of withdrawals.	VIII % of withdrawals.	All Grades. % of withdrawals.	
10 or less.	15.0	15.7	15.0	12.4	
11 - 15	(10.6)	13.6	13.1	11.5	
16 - 20	10.9	12.0	9.9	(11.3)	
21 - 25	13.7	13.8	10.1	12.8	
26 - 30	18.1	(9.4)	12.7	14.3	
31 - 35	13.5	15.6	13.8	14.4	- - - 12.8 %
36 - 45	17.4	16.4	(8.6)	14.7	
46 - 55	18.3	9.5	9.7	15.2	
56 - up.	33.3	18.7	11.1	20.4	- - - 16.8 %
	16.5	13.8	11.6	14.1	

See Figures XXVII to XXXV for graphic representation.

Beginning at the top this table is to be read,- In Grade I in classes with an enrollment of 10 pupils or less 7.7% of all pupils enrolled were permanently withdrawn from the class during the year; in Grade II, 8.6%; etc. Figures enclosed thus (____) represent the lowest percentage of withdrawals for each grade.

The above table shows the following facts:- (1) The lowest percentage of withdrawals, with the exception of Grades VII and VIII, falls within clssses of 20 pupils or less. (2) The highest percentage of withdrawals, with the exceptions of Grades V and VIII, falls within classes of 36 pupils or more. (3) There is a somewhat regular increase in the rate of withdrawals as the size of the class increases, both grade by grade and in the averages for all grades. (4) The larger classes have a higher percentage of withdrawals by 4% than do the smaller classes. The figures at the right of the last column show the average rate of withdrawals for classes with an enrollment of 35 pupils or less and for classes with an enrollment of 36 pupils or more.

From these four facts one might conclude that the increase in the number of pupils per class tends to produce a corresponding

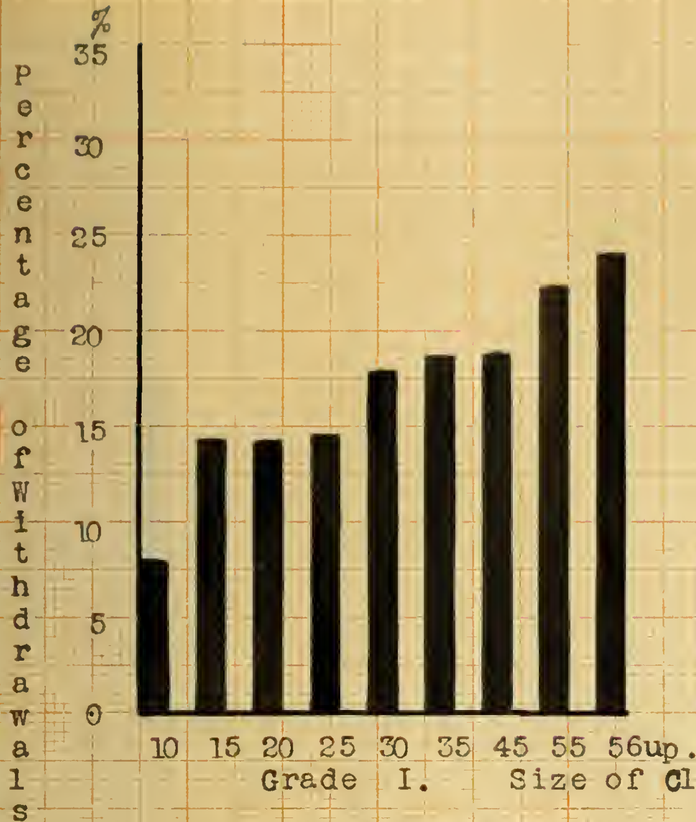


FIGURE XXVII.

FIGURE XXVIII.

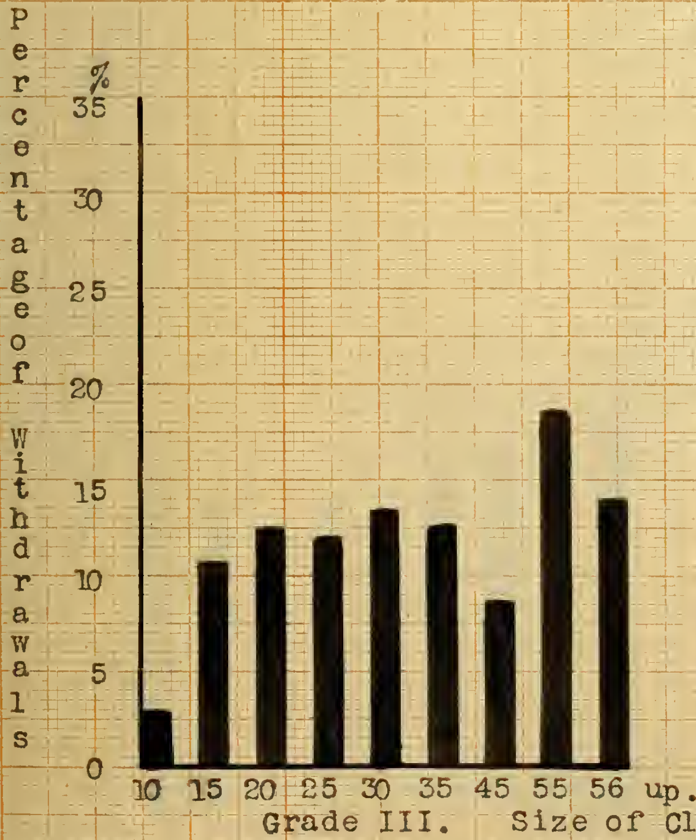


FIGURE XXIX.

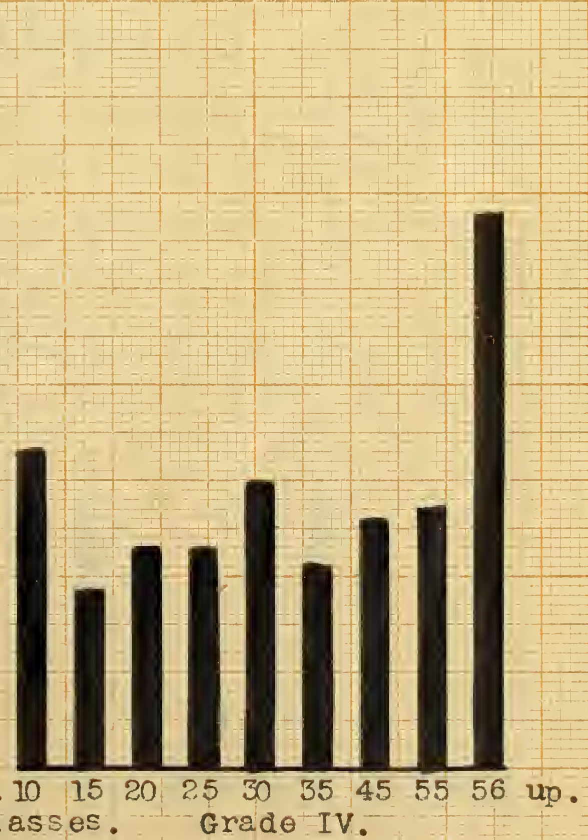


FIGURE XXX.

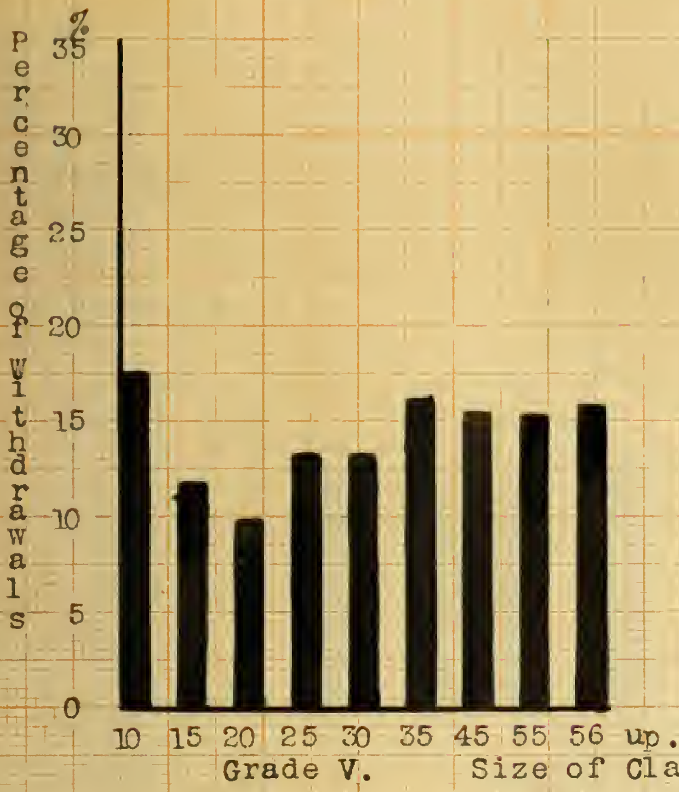
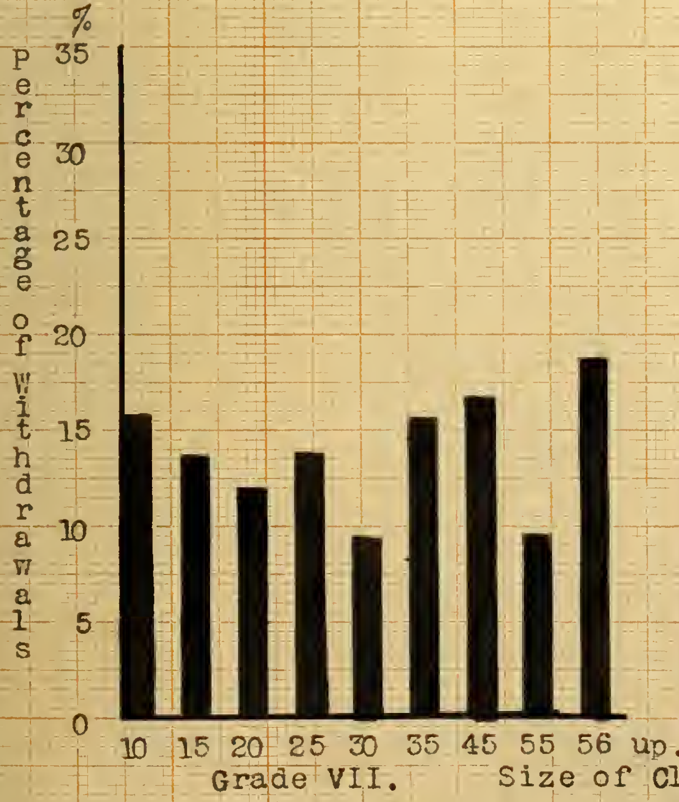


Figure XXXI.

FIGURE XXXII.



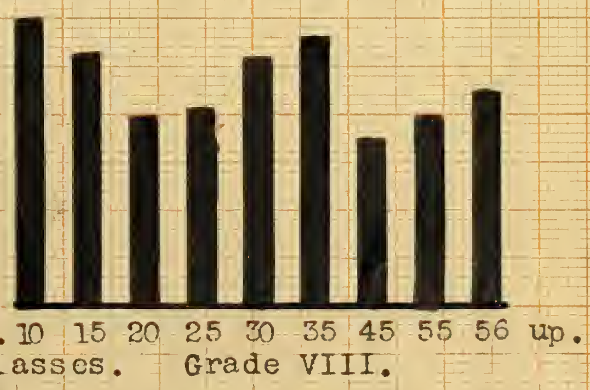


FIGURE XXXIII.

FIGURE XXXIV.

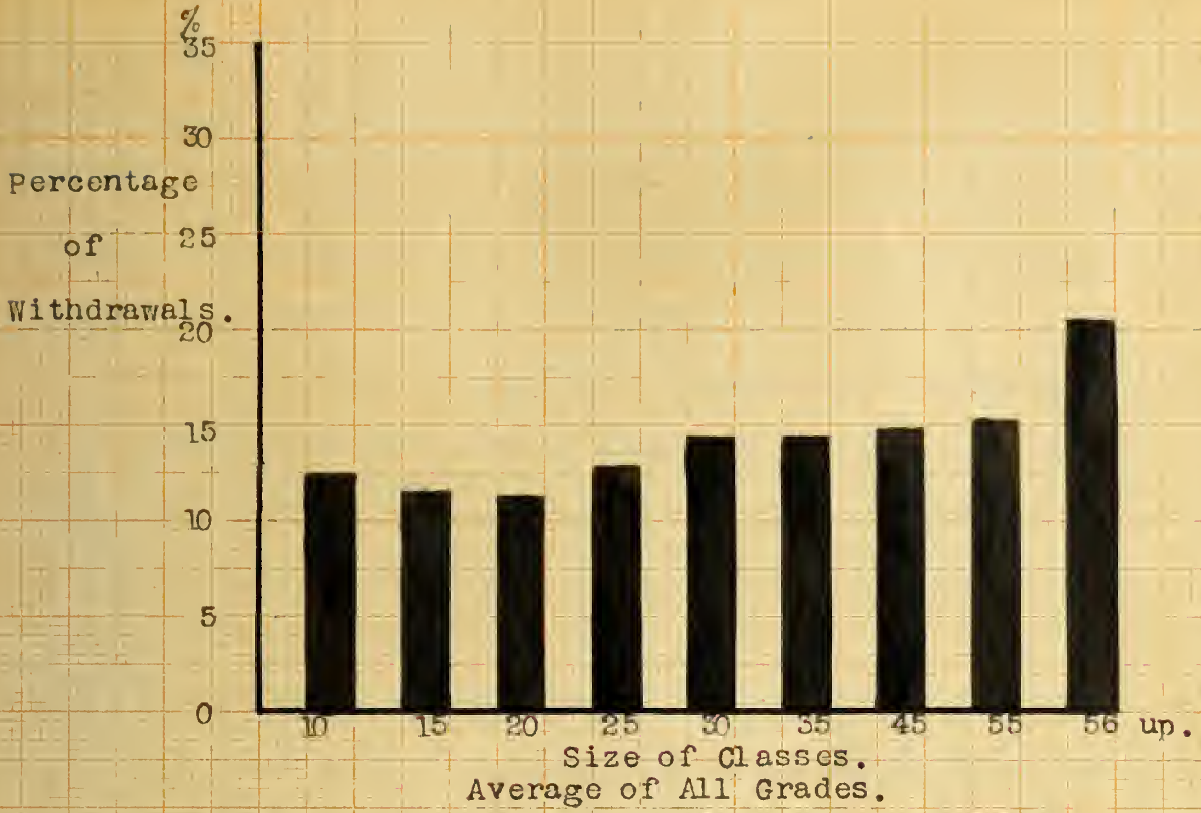

%
35
30
Percentage
of
25
Withdrawals.
20
15
10
5
0
10
15
20
25
30
35
45
55
56 up.
Size of Classes.
Average of All Grades.

FIGURE XXXV.

increase in the percentage of withdrawals. Such a conclusion is based upon the assumption of a causal relationship between the size of the class and the number of pupils withdrawn from the class. We cannot be sure that this relationship exists but the evidence at hand seems to favor its existence.

The most important causes of permanent withdrawal are:- (1) Removal from the city or school district. (2) Death or long continued illness. (3) Home conditions which make it necessary for pupils to go to work. (4) In cases where the compulsory attendance laws are inoperative, a dislike for school or indifference to the value of education.

The first three of these causes are extra-school causes and if the size of the class is in any way related to them it must be only indirectly. They may, however, be given as reasons for withdrawal when the last cause mentioned is the real cause of the withdrawal.

The fourth cause is partly within the school and in many cases may be the cause of withdrawal from the class. Less efficient teaching and slower progress of pupils, which may be more prevalent in large classes than in small ones, may cause a dislike for school work and an indifference to its value, and consequently a dropping out of the class.

The larger classes are found in schools, where over-crowded conditions exist. One cause of over crowding is retardation due to a low promotion rate. Ayres (1) has pointed out that non-promotion is one of the chief causes of elimination. Now if large

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(1) Leonard P. Ayres, Laggards in Our Schools, Ch. IX, P 101 -102.

classes result from congestion due to retardation, and retardation resulting from non-promotion, is the chief cause of elimination, then we may expect the effect of large classes to be expressed either in a low promotion rate or in a high percentage of withdrawals. Since the promotion rate was only slightly lower for large than for small classes we should expect to find the percentage of withdrawals increasing as the classes become larger. This is exactly the result shown in Table XII.

The facts of Table XII are sufficient to justify the following conclusions:-

(1) The percentage of withdrawals from classes of 35 pupils or less is lower by 4% than for classes of 36 pupils or more.

(2) The larger the class the higher is the rate of withdrawals.

(3) The percentage of withdrawals, when properly interpreted, may be used as a partial measure of the effect of the size of the class.

CHAPTER VI.

The size of the class and achievement in Arithmetic as measured by the Courtis Tests.

Tests of achievements of classes in the different school subjects offer opportunities for comparing the relative efficiency of large, medium and small classes. One of the most definite of these tests is the Courtis Tests in Arithmetic. If one were to compare the class scores made in the Courtis Tests for classes varying in size, and should find that small classes in general make higher scores than do large classes, one would have some definite data from which to argue for a reduction in the size of classes. The scores from these tests were used in this study and a brief description of the tests and their uses may not be out of place here.

The Courtis Tests consist of a series of simple problems so arranged that each example is of equal difficulty with any other in the same test. There are eight tests each consisting of more examples than the most rapid pupil can solve in the time given. Test 1 is a series of simple problems in Addition, Test 2, in Subtraction, Test 3, in Multiplication, Test 4, in Division, Test 5, in Copying Figures, Test 6, simple one-step problems in reasoning, Test 7, problems in the Fundamentals, i.e. abstract problems in Addition, Subtraction, Multiplication and Division, and Test 8, a series of more complex two-step problems in reasoning. Tests 1, 2, 3, and 4 are designed to test ones knowledge of and facility in applying the tables of the forty-five number combinations. Test 5 is a test of motor ability in copying figures. Test 6 is a test of the pupil's ability to read a problem and determine from the

reading what arithmetical process should be used in solving it. Test 7 is a test in speed and accuracy in solving abstract problems involving all of the operations in addition, subtraction, multiplication, and division. Test 8 is intended to test the pupil's ability to solve two-step problems in reasoning. The time limits for these tests is as follows:- Tests 1, 2, 3, 4, 5, and 6, each one minute; Test 7, 12 minutes, and Test 8, 6 minutes.

It will be seen that Test 5 is designed to test abilities which the school does not definitely seek to cultivate while Test 7 is perhaps the best test of abilities which the school does seek definitely to cultivate. It is obvious that the scores for Test 5 could not in any way be affected by the size of the class, while the scores in Test 7 should be affected, if the size of the class is a determining factor in achievement in Arithmetic.

The term "score" is used to designate the number of examples solved in any test. In Tests 6, 7, and 8 both the number of examples attempted and the number right are given in the scores.

Mr. Courtis has obtained and has on file in his work room in Detroit the individual scores for many thousands of children representing a very wide distribution of cities in the United States. He also has the class scores for these same individuals and cities. Mr. Courtis very kindly gave permission to copy as many of the class scores as would be required in making this investigation. This permission was given with the understanding that the names of the cities from which the scores were obtained were not to be used in connection with the results, hence no names appear in this report.

The scores of 17,597 individuals representing 675 classes

are used in this study. The cities furnishing the data are distributed as follows: Michigan 5 cities, Indiana 4, Massachusetts 3, New York, Illinois, and Virginia, 2 each, and North Carolina, Delaware, Minnesota, and Kansas, one each, making a total of 22 cities. The scores used are a random sampling of all the scores on file in Mr. Courtis' work room. They should, therefore, include all the varying conditions likely to affect, in any way, the averages obtained.

The following are sources of error in the data:-

(1) Sufficient reliable scores for grades below the Third were not available as the nature of the tests is such that they can not be used in Grades I and II. Hence no comparison of the achievements of children in those grades can be made.

(2) The number in the class represents the number present and taking all the tests on the day the tests were given. It will be seen that the actual size of the class is not represented by these numbers. Some pupils may have been absent when a part or all of the tests were given, or, some pupils may not have understood the directions consequently such scores had to be discarded. Under these conditions the size of the class as used in these data will be somewhat less than the actual size of the class. No record of the actual number belonging was obtainable for correcting this error. However, for purposes of comparison this discrepancy is not sufficiently serious to vitiate the results.

(3) The average of the class scores is used for comparison, no attempt being made to compare the whole distribution of classes of each size with each other. It was assumed that if there were differences in the class scores favoring either large or small

classes these differences would be shown by the averages.

The distribution of classes and of pupils as to the size of the class is given in Table XIII.

TABLE XIII.
(Showing distribution of classes and of pupils.)

Size of Classes.	No. of classes.	% each group is of total.	No. of pupils.	% each group is of total.
10 or less.	30	4.5	259	1.5
11 - 15	78	11.5	930	5.4
16 - 20	129	19.1	2310	13.2
21 - 25	117	17.3	2684	15.2
26 - 30	95	14.1	2527	14.4
31 - 35	79	11.7	2598	14.7
36 - 45	102	15.1	3989	22.6
46 - 55	34	5.1	1687	9.5
56 - up.	11	1.6	613	3.5
	675	100.	17597	100.

See Figure XXXIV for graph of the above distributions.

The above table should be read, - 30 classes or 4.5% of all classes had 10 or less pupils present on the day the tests were given, and 259 pupils or 1.5% of all pupils were in classes of 10 pupils or less on the day the tests were given, etc. No new facts of importance are presented in Table XIII.

In computing the class scores the following formula was followed: -

$$\frac{\text{Sum of individual scores}}{\text{No. of individuals in class on day tests were given}} = \text{Class scores.}$$

After the class scores were obtained the classes were arranged according to size as shown in Table XIII. The average for all classes of each size-group as well as the average for each grade was then computed. We now have the averages for each grade without reference to the size of class, and the averages for all classes arranged in groups according to size. The group averages were then compared with the grade averages and the deviation of the former from the latter obtained. These deviations were then marked

plus or minus according to whether they fell above or below the grade average. Table XIV shows the results of these computations for all groups grade by grade, in each of the eight tests.

If the size of the class is of only slight importance or of no importance in determining achievement in arithmetic then there should be no regular increase or decrease in the average scores as the size of the class increases. Also the number of plus and minus deviations from the grade average should be equal or approximately equal for large and for small classes. But should we find that the average scores decrease as the size of the class increases, and that the minus deviations from the grade average are for large classes and the plus deviations are for small classes, we should have conclusive evidence that there is direct correlation between the size of class and the achievement of children in arithmetic.

TABLE XIV.
(Showing average scores in classes of different sizes and deviations from the grade average.)

Grade III.

	Test 1		Test 2		Test 3		Test 4		Test 5	
	Score.	Dev.	Score.	Dev.	Score.	Dev.	Score.	Dev.	Score.	Dev.
10 or less	19	- 6	19	0	17	+ 2	17	+ 2	60	- 1
11 - 15	25	0	20	+ 1	17	+ 2	15	- 0	64	+ 3
16 - 20	(32)	+ 7	(28)	+ 9	19	+ 4	14	- 1	65	+ 4
21 - 25	28	+ 3	20	+ 1	17	+ 2	(25)	+10	57	- 4
26 - 30	24	- 1	13	- 6	9	- 6	10	- 5	61	0
31 - 35	25	0	18	- 1	11	- 4	9	- 6	64	+ 3
36 - 45	23	- 2	17	- 2	15	0	12	- 3	(66)	+ 5
46 - 55	24	- 1	17	- 2	15	0	15	0	54	- 7
56 - up.	29	+ 4	22	+ 3	(20)	+ 5	20	+ 5	62	+ 1
Grade Average.	25		19		15		15		61	

TABLE XIV. (Cont.)
Grade III. (Cont.)

Size of	Test 6.				Test 7.			
	Attempts.		Rights.		Attempts.		Rights.	
classes.	Score.	Dev.	Score.	Dev.	Score.	Dev.	Score.	Dev.
10 or less.	1.3	-1.4	.1	-1.3	5.3	0	1.3	-.1
11 - 15	3.2	+.5	1.2	-.2	6.1	+.8	(1.7)	+.3
16 - 20	2.1	-.6	1.3	-.1	5.7	+.4	1.5	+.1
21 - 25	2.8	+.1	1.5	+.1	5.2	-.1	1.4	.0
26 - 30	1.9	-.8	1.0	-.4	4.5	-.8	1.5	+.1
31 - 35	3.4	+.7	1.4	0	6.2	+.9	1.5	+.1
36 - 45	(3.6)	+.9	1.7	+.3	5.3	0	1.6	+.2
46 - 55	3.1	+.4	2.0	+.6	(6.6)	+1.3	1.3	-.1
56 - up.	3.0	+.3	(2.7)	+1.3	3.0	-2.3	1.0	-.4
Grade Average.	2.7		1.4		5.3		1.4	

Size of	Test 8				No. of	No. of
	Attempts.		Rights.			
classes.	Score.	Dev.	Score.	Dev.	classes.	pupils.
10 or less.	1.1	-.4	.1	-.3	2	18
11 - 15	2.3	+.8	.4	0	12	163
16 - 20	2.3	+.8	0	0	7	112
21 - 25	-----		-----		6	132
26 - 30	1.6	+.1	.5	+.1	10	277
31 - 35	-----		-----		3	102
36 - 45	1.6	+.1	(.5)	+.1	8	309
46 - 55	(2.4)	+.9	0		6	307
56 - up.	1.0	-.5	.5	+.1	2	131
Grade Average.	1.5		.4		56	1551

Grade IV.

Size of	Test 1		Test 2		Test 3		Test 4		Test 5	
classes.	Score.	Dev.	Score.	Dev.	Score.	Dev.	Score.	Dev.	Score.	Dev.
10 or less.	23	-13	16	-9	14	-10	13	-10	66	-5
11 - 15	28	-8	20	-5	24	0	18	-5	75	+4
16 - 20	35	-1	26	+1	23	-1	21	-2	75	+4
21 - 25	42	+6	(29)	+4	27	+3	27	+4	76	+5
26 - 30	42	+6	28	+3	26	+2	23	0	(76)	+5
31 - 35	38	+2	30	+5	(29)	+7	24	+1	69	-2
36 - 45	34	-2	25	0	23	-1	22	-1	74	+3
46 - 55	(43)	+7	28	+3	27	+3	(30)	+7	74	+3
56 - up.	33	-3	23	-2	22	-2	23	0	59	-12
Grade Average.	36		25		24		23		71	

TABLE XIV. (Cont.)
Grade IV. (Cont.)

Size of classes.	Test 6 Attempts. Score.	Test 6 Attempts. Dev.	Test 6 Rights. Score.	Test 6 Rights. Dev.	Test 7 Attempts. Score.	Test 7 Attempts. Dev.	Test 7 Rights. Score.	Test 7 Rights. Dev.
10 or less.	2.0	-1.5	1.1	- .9	6.9	- .6	1.5	-2.0
11 - 15	2.8	- .7	1.9	- .1	8.1	+ .6	4.0	+ .5
16 - 20	3.5	0	2.0	0	7.2	- .3	3.4	- .1
21 - 25	3.3	- .2	2.1	+ .1	7.8	+ .3	4.1	+ .6
26 - 30	3.2	- .3	1.7	- .3	7.3	- .2	3.5	0
31 - 35	3.5	0	1.9	- .1	(8.4)	+ .9	(4.2)	+ .7
36 - 45	3.2	- .3	1.9	- .1	7.6	+ .1	3.4	- .1
46 - 55	(4.3)	+ .8	(2.8)	+ .8	7.2	- .3	3.7	+ .2
56 - up.	4.0	+ .5	2.8	+ .8	6.6	- .9	3.5	0
Grade Average.	3.5		2.0		7.5		3.5	

Size of classes.	Test 8 Attempts. Score.	Test 8 Attempts. Dev.	Test 8 Rights. Score.	Test 8 Rights. Dev.	No. of classes.	No. of pupils.
10 or less.	2.2	- .5	.4	- .4	4	34
11 - 15	2.2	- .5	.6	- .2	8	113
16 - 20	2.6	- .1	.6	- .2	28	498
21 - 25	(3.3)	+ .6	.9	+ .1	24	543
26 - 30	2.1	- .6	.6	- .2	21	563
31 - 35	2.6	- .1	.8	0	8	266
36 - 45	2.5	- .2	1.0	+ .2	14	541
46 - 55	3.1	+ .4	.8	0	9	449
56 - up.	3.0	+ .3	(1.1)	+ .3	2	112
Grade Average.	2.7		.8		118	3119

Grade V.

Size of classes.	Test 1 Score.	Test 1 Dev.	Test 2 Score.	Test 2 Dev.	Test 3 Score.	Test 3 Dev.	Test 4 Score.	Test 4 Dev.	Test 5 Score.	Test 5 Dev.
10 or less.	35	- 7	26	- 5	24	- 8	25	- 4	79	- 1
11 - 15	35	- 7	33	+ 2	31	- 1	28	- 1	85	+ 5
16 - 20	42	0	35	+ 4	35	+ 3	31	+ 2	85	+ 5
21 - 25	44	+ 2	32	+ 1	34	+ 2	26	- 3	83	+ 3
26 - 30	43	+ 1	32	+ 1	33	+ 1	33	+ 4	81	+ 1
31 - 35	40	- 2	29	- 2	32	0	29	0	82	+ 2
36 - 45	(50)	+ 8	(39)	+ 8	(41)	+ 9	(39)	+10	(91)	+11
46 - 55	41	- 1	24	- 7	28	- 4	24	- 5	53	-27
56 - up.	39	- 3	28	- 3	25	- 7	25	- 4	83	+ 3
Grade Average.	42		31		32		29		80	

TABLE XIV. (Cont.)
Grade V. (Cont.)

Size of classes.	Test 6. Attempts. Score.	Dev.	Rights. Score.	Dev.	Test 7. Attempts. Score.	Dev.	Rights. Score.	Dev.
10 or less.	4.8	+ .8	3.5	+ .3	8.6	- .2	5.0	- .1
11 - 15	4.1	- .5	2.9	- .3	8.5	- .3	5.5	+ .4
16 - 20	4.2	- .4	2.6	- .6	9.3	+ .5	5.2	+ .1
21 - 25	4.1	- .5	2.9	- .3	9.5	+ .7	5.2	+ .1
26 - 30	4.6	0	3.5	+ .3	8.4	- .4	5.2	+ .1
31 - 35	4.5	- .1	2.4	- .8	(9.7)	+ .9	5.7	+ .6
36 - 45	4.9	+ .3	3.5	+ .3	9.7	+ .9	(5.9)	+ .8
46 - 55	(5.1)	+ .5	3.7	+ .5	6.3	-2.5	3.7	-1.4
56 - up.	5.0	+ .4	(3.9)	+ .7	9.0	+ .2	5.0	- .1
Grade Average.	4.6		3.2		8.8		5.1	

Size of classes.	Test 8 Attempts. Score.	Dev.	Rights. Score.	Dev.	No. of classes.	No. of pupils.
10 or less.	2.1	- .8	.8	- .4	6	51
11 - 15	2.5	- .4	1.2	0	16	216
16 - 20	2.9	0	1.2	0	35	604
21 - 25	3.4	+ .5	1.5	+ .3	22	509
26 - 30	2.7	- .2	1.0	- .2	21	596
31 - 35	2.7	- .2	1.1	- .1	15	492
36 - 45	(3.4)	+ .5	(1.6)	+ .4	17	665
46 - 55	2.8	- .1	1.3	+ .1	5	260
56 - up.	2.7	- .2	1.3	+ .1	1	57
Grade Average.	2.9		1.2		138	3450

Grade VI.

Size of classes.	Test 1. Scores.	Dev.	Test 2. Scores.	Dev.	Test 3. Scores.	Dev.	Test 4. Scores.	Dev.	Test 5. Scores.	Dev.
10 or less.	48	+ 3	(41)	+ 5	(39)	+ 3	(38)	+ 2	(103)	+13
11 - 15	45	0	36	0	37	+ 1	37	+ 1	89	- 1
16 - 20	44	- 1	35	- 1	36	0	35	- 1	87	- 3
21 - 25	44	- 1	37	+ 1	37	+ 1	36	0	92	+ 2
26 - 30	44	- 1	38	+ 2	34	- 2	37	+ 1	91	+ 1
31 - 35	(49)	+ 4	34	- 2	36	0	36	0	91	+ 1
36 - 45	45	0	34	- 2	38	+ 2	34	- 2	91	+ 1
46 - 55	44	- 1	33	- 3	34	- 2	35	- 1	74	-16
56 - up.	0		0		0		0		0	
Grade Average.	45		36		36		36		90	

TABLE XIV. (Cont.)

Grade VI. (Cont.)

Size of classes.	Test 6. Attempts. Score.	Dev.	Rights. Score.	Dev.	Test 7. Attempts. Score.	Dev.	Rights. Score.	Dev.
10 or less.	5.2	+ 2	3.7	+ 1	11.1	+ 5	5.7	- 7
11 - 15	4.9	- 1	3.3	- 3	10.6	0	6.1	- 3
16 - 20	4.6	- 4	3.3	- 3	10.2	- 4	6.8	+ 2
21 - 25	4.9	- 1	3.6	0	10.1	- 5	6.7	+ 3
26 - 30	5.0	0	(3.9)	+ 3	(11.8)	+1.2	(7.5)	+1.1
31 - 35	(5.5)	+ 5	3.7	+ 1	10.9	+ 3	6.5	+ 1
36 - 45	4.8	- 2	3.1	- 5	10.4	- 2	6.4	- 0
46 - 55	5.2	+ 2	3.9	+ 3	9.6	- 1	5.9	- 5
56 - up.	0		0		0		0	
Grade Average.	5.0		3.6		10.6		6.4	

Size of classes.	Test 8 Attempts. Score.	Dev.	Rights. Score.	Dev.	No. of classes.	No. of pupils.
10 or less.	3.0	0	1.6	0	4	30
11 - 15	3.2	+ 2	1.7	+ 1	12	164
16 - 20	2.9	- 1	1.6	0	27	482
21 - 25	3.0	0	1.7	+ 1	23	528
26 - 30	(3.5)	+ 5	(2.1)	+ 5	12	330
31 - 35	2.9	- 1	1.5	- 1	20	660
36 - 45	2.7	- 3	1.4	- 2	26	999
46 - 55	3.0	0	1.7	+ 1	7	339
56 - up.	0		0		0	0
Grade Average.	3.0		1.6		131	3532

Grade VII.

Size of classes.	Test 1 Score.	Dev.	Test 2 Score.	Dev.	Test 3 Score.	Dev.	Test 4 Score.	Dev.	Test 5 Score.	Dev.
10 or less.	44	- 8	38	- 3	38	- 2	38	- 2	106	+ 6
11 - 15	46	- 6	38	- 3	36	- 4	36	- 4	99	- 1
16 - 20	41	-11	40	- 1	37	- 3	38	- 2	101	+ 1
21 - 25	52	0	42	+ 1	38	- 2	40	0	(109)	+ 9
26 - 30	53	+ 1	43	+ 2	40	0	38	- 2	99	- 1
31 - 35	62	+10	(47)	+ 6	(52)	+12	(46)	+ 6	102	+ 2
36 - 45	55	+ 3	42	+ 1	40	0	40	0	95	- 5
46 - 55	(63)	+11	42	+ 1	40	0	41	+ 1	95	- 5
56 - up.	51	- 1	41	0	35	- 5	38	- 2	98	- 2
Grade Average.	52		41		40		40		100	

TABLE XIV. (Cont.)

Grade VII. (Cont.)

Size of classes.	Test 6.				Test 7.			
	Attempts.		Rights.		Attempts.		Rights.	
	Score.	Dev.	Score.	Dev.	Score.	Dev.	Score.	Dev.
10 or less.	5.4	-.2	4.0	-.5	12.1	-.1	7.0	-1.1
11 - 15	5.0	-.6	3.9	-.6	11.6	-.6	8.0	-.1
16 - 20	5.4	-.2	4.2	-.3	11.7	-.5	8.4	+.3
21 - 25	5.4	-.2	4.4	-.1	11.5	-.7	7.9	-.2
26 - 30	5.5	-.1	4.1	-.4	12.1	-.1	7.6	-.5
31 - 35	6.2	+.6	(5.2)	+.7	12.9	+.7	8.8	+.7
36 - 45	6.2	+.6	4.8	+.3	12.9	+.7	8.2	+.1
46 - 55	(6.4)	+.8	5.2	+.7	(13.0)	+.8	(8.8)	+.7
56 - up.	4.8	-.8	4.4	-.1	11.8	-.4	8.3	+.2
Grade Average.	5.6		4.5		12.2		8.1	

Size of classes.	Test 8				No. of classes.	No. of pupils.
	Attempts.		Rights.			
	Score.	Dev.	Score.	Dev.		
10 or less.	3.2	-.5	1.9	-.2	8	75
11 - 15	4.1	+.4	2.2	+.1	21	288
16 - 20	(4.1)	+.4	2.1	0	15	272
21 - 25	3.4	-.3	2.1	0	20	464
26 - 30	3.6	-.1	1.9	-.2	20	570
31 - 35	3.9	+.2	(2.5)	+.4	16	523
36 - 45	3.5	-.2	2.1	0	18	676
46 - 55	4.1	+.4	2.2	+.1	4	185
56 - up.	3.4	-.3	2.4	+.3	2	114
Grade Average.	3.7		2.1		124	3167

Grade VIII.

Size of classes.	Test 1		Test 2		Test 3		Test 4		Test 5	
	Score.	Dev.	Score.	Dev.	Score.	Dev.	Score.	Dev.	Score.	Dev.
10 or less.	52	- 5	43	- 5	45	+ 2	40	- 4	99	- 4
11 - 15	57	0	48	0	44	+ 1	45	+ 1	(109)	+ 6
16 - 20	58	+ 1	45	- 3	41	- 2	45	+ 1	100	- 3
21 - 25	58	+ 1	44	- 4	43	- 0	43	- 1	108	+ 5
26 - 30	61	+ 4	48	0	42	- 1	(48)	+ 4	101	- 2
31 - 35	54	- 3	45	- 3	39	- 4	44	0	105	+ 2
36 - 45	(62)	+ 5	(59)	+11	(48)	+ 5	47	+ 3	104	+ 1
46 - 55	51	- 6	42	- 6	38	- 5	40	- 4	100	- 3
56 - up.	53	- 4	43	- 5	38	- 5	41	- 3	102	- 1
Grade Average.	57		48		43		44		103	

TABLE XIV. (Cont.)

Grade VIII. (Cont.)

Size of classes.	Test 6 Attempts. Score.	Dev.	Rights. Score.	Dev.	Test 7 Attempts. Score.	Dev.	Rights. Score.	Dev.
10 or less.	5.6	- .6	4.5	- .7	13.3	0	8.7	- .5
11 - 15	5.6	- .6	4.5	- .7	12.8	- .5	9.1	- .1
16 - 20	6.4	+ .2	5.4	+ .2	12.7	- .6	9.2	0
21 - 25	6.0	- .2	5.0	- .2	13.5	+ .2	9.4	+ .2
26 - 30	6.5	+ .3	5.6	+ .4	13.2	- .1	9.6	+ .4
31 - 35	6.2	0	5.0	- .2	14.4	+1.1	(9.9)	+ .7
36 - 45	6.5	+ .3	5.5	+ .3	(14.8)	+1.5	9.4	+ .2
46 - 55	(6.7)	+ .5	(6.0)	+ .8	12.8	- .5	8.6	- .6
56 - up.	6.0	- .2	5.3	+ .1	12.5	- .8	8.8	- .4
Grade Average.	6.2		5.2		13.3		9.2	

Size of classes.	Test 8 Attempts. Score.	Dev.	Rights. Score.	Dev.	No. of classes.	No. of pupils.
10 or less.	4.3	+ .3	2.5	- .1	6	53
11 - 15	3.9	- .1	2.4	- .2	9	126
16 - 20	4.2	+ .2	(3.9)	+1.3	17	312
21 - 25	4.0	0	2.6	0	22	504
26 - 30	3.4	- .6	2.3	- .3	7	191
31 - 35	3.8	- .2	2.7	+ .1	17	555
36 - 45	(4.3)	+ .3	2.7	+ .1	19	689
46 - 55	4.1	+ .1	2.8	+ .2	3	149
56 - up.	4.0	0	2.7	+ .1	3	199
Grade Average.	4.0		2.6		103	2778

Beginning on page 34 Table XIV should be read;- In Grade III in classes of 10 pupils or less the average score in Test 1, is 19 with a deviation below the grade average of 6 examples; in Test 2 the score is 19 with no deviation from the grade average; in Test 3, 17 with a deviation of 2 above the grade average, etc. The last two columns in the table for each grade give the number of classes and the number of individual scores upon which the averages are based. The figures enclosed thus (______) represent the highest average scores in each test for each grade.

By counting through Table XIV it is possible to determine the number of times the maximum average scores are found in any class group. In all of the tests for any grade it is possible for any class-group to make 11 maximum scores; in all of the six grades tested it is possible for any class-group to make 66 maximum scores. It can easily be seen from Table XIV that no one class group has all or even half of the maximum scores. Table XV shows the exact distribution of maximum scores according to the size of the class.

TABLE XV.
(Showing number of times maximum scores are found in any class-group.)

Size of classes.	Number of maximum scores in any class group.	% each number is of total.	Added percentages.
10 or less.	4	6.0	6.0
11 - 15	2	3.0	9.0
16 - 20	4	6.0	15.0
21 - 25	4	6.0	21.0
26 - 30	7	10.6	31.6
31 - 35	12	18.2	49.8
36 - 45	16	24.2	74.0
46 - 55	13	20.0	94.0
56 - up.	4	6.0	100.
	66	100.	

See Figure XXXV for graphic representation of the above.

The above table should be read,- 4 maximum average scores out of a possible 66, or 6% of all maximum scores were made by classes with an enrollment of 10 pupils or less, 2, or 3% of all maximum scores were made in classes of from 11 to 15 pupils, etc.

It will be noted that the largest percentage of maximum scores was made in classes of from 31 to 55 pupils, and that the highest single percentage falls in the 36 to 45 class group. These facts however, are not significant when one considers that there are maximum scores made in classes of every size, only about one-fourth of all the highest scores being made in classes of from 36 to 45 pupils.

Distribution of Classes and Pupils
According to Size of Classes.

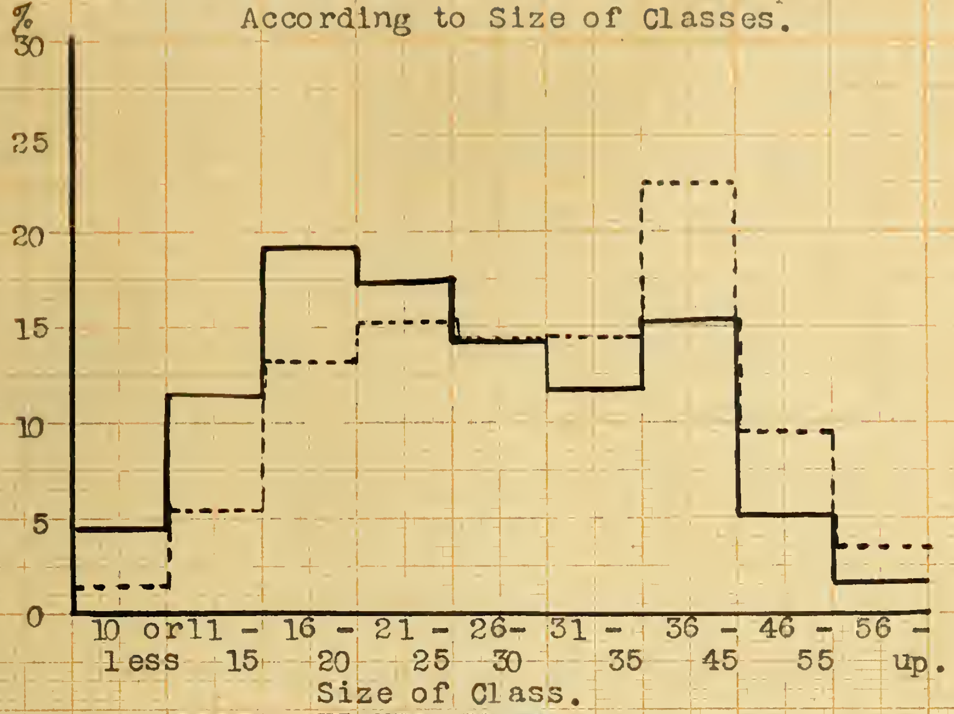


FIGURE XXXVI.

Distribution of Maximum Scores according
Size of Classes.

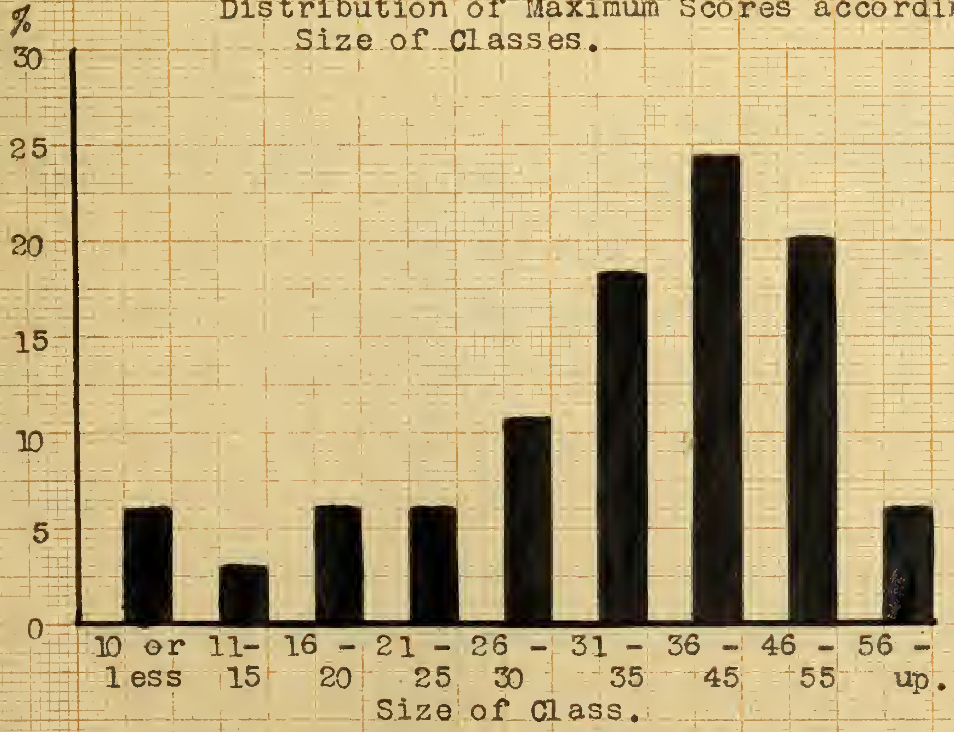


FIGURE XXXVII.

An examination of Tables XIV and XV shows the following facts:- (1) There is no decrease in the average scores in any of the tests, as the size of the class increases. (2) The maximum scores are distributed throughout the class groups with a slight tendency to cluster in classes with an enrollment of 31 to 55 pupils. (3) There are approximately as many plus deviations as minus deviations in the large, medium, and small class-groups. (4) In Test 5, a test of speed in copying figures, (an ability which the school does not seek to cultivate) we find approximately the same degree of variability in the deviations as in Test 7, (a test of arithmetical abilities which the school does seek emphatically to cultivate.) If the size of the class were a modifying factor its effects should be apparent in the results of Test 7 if anywhere.

Table XVI shows the results of combining the deviations of each group for all the grades. The combination was made according to the following formula;-

$$\frac{\text{Algebraic sum of the deviates of each group for all grades}}{\text{Number of grades represented (six).}} = \text{Ave.}$$

If the correlation between the size of class and achievement in arithmetic were direct we should find all of the plus deviates in the smaller class groups, all of the zero deviates in the medium class groups, and all of the minus deviates in the larger class groups. If the correlation is low or lacking the plus, minus and zero deviates would be scattered promiscously throughout the class groups without any reference to the size of class. This latter condition prevails in Table XVI. It is modified, however, to the extent that the plus deviates are slightly more numerous

in the medium sized class groups.

TABLE XVI.

(Showing deviations from grade average in each test for all grades)

Size of classes.	Test 1. Deviates.	Test 2. Deviates.	Test 3. Deviates.	Test 4. Deviates.	Test 5 Deviates.	Test 6.Ats. Deviates.
10 or less.	-6	-2.8	-2.2	-2.3	+1.3	- .55
11 - 15	-3.5	- .8	- .2	-1.3	+2.7	- .33
16 - 20	- .8	+1.5	+ .2	- .5	+1.3	- .23
21 - 25	+1.8	+ .7	+1.0	+1.7	+3.3	- .18
26 - 30	+1.7	+ .3	-1.0	+ .3	+ .7	- .15
31 - 35	+1.8	+ .5	+1.8	+ .2	+1.3	+ .28
36 - 45	+2.1	+2.8	+2.2	+1.3	+2.7	+ .27
46 - 55	+ .9	-2.0	-1.1	- .1	-8.7	+ .53
56 - up.	-1.7	-1.2	-2.3	- .7	-1.8	+ .07

Size of classes.	Test 6. Rights. Deviates.	Test 7. Attempts. Deviates.	Test 7. Rights. Deviates.	Test 8. Attempts. Deviates.	Test 8. Rights. Deviates.
10 or less.	- .5	- .07	- .45	- .3	- .2
11 - 15	- .37	0	+ .11	+ .07	- .03
16 - 20	- .18	- .15	+ .1	+ .2	+ .2
21 - 25	- .07	0	+ .17	+ .2	+ .1
26 - 30	0	- .07	+ .33	- .3	- .05
31 - 35	- .05	+ .8	+ .5	- .07	+ .05
36 - 45	+ .1	+ .5	+ .2	+ .07	+ .14
46 - 55	+ .6	- .4	- .3	+ .18	- .04
56 - up.	+ .47	- .8	- .2	- .1	+ .15

See Figures XXXVI to XXXXVI for graphic representation.

The above table becomes clear when read, - In Test 1 in classes of 10 pupils or less the average score is 6 examples below the grade average for all grades; in Test 2, 2.8 examples below the grade average for all grades, etc.

The following facts are apparent in Table XVI:- (1) There is the same scattering of the plus and minus deviates among the different class groups as was shown in Table XIV. (2) Most of the plus deviates are in the medium sized class groups, while the minus deviates are more numerous in the large and in the small class groups. (3) In Test 5 the plus deviates are all in classes of 45 pupils or less, while in Test 6 the plus deviates are all

Figures at the left represent deviations from grade average, Gr.Av., in these diagrams marked 0.

FIGURE XXXVI
Test 1.

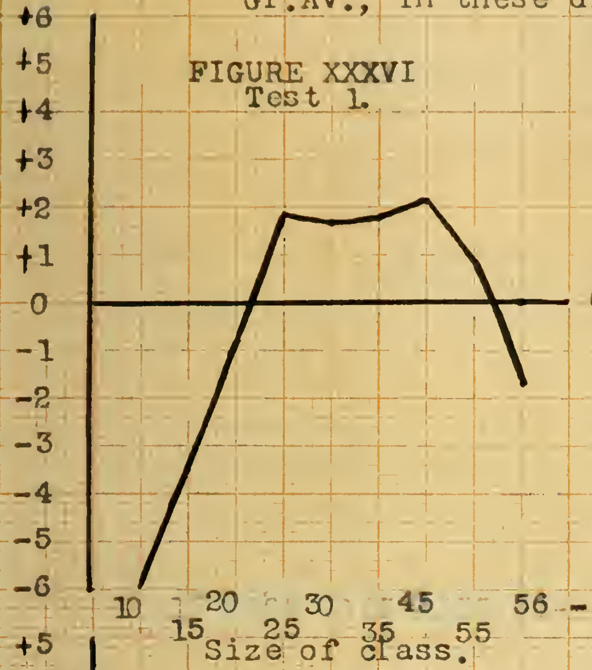


FIGURE XXXVII.
Test 2.

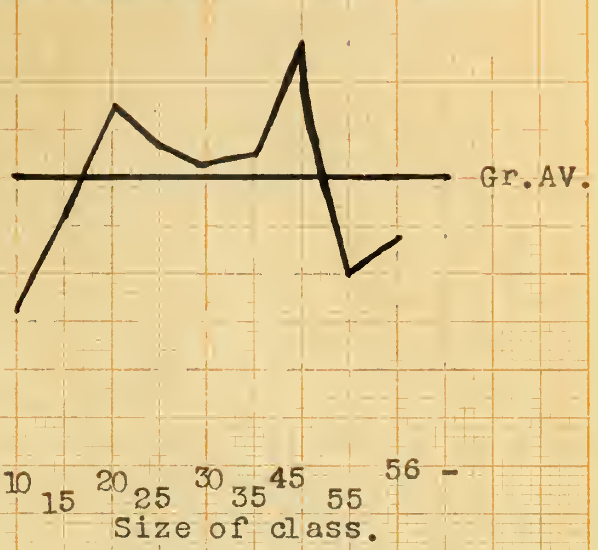


FIGURE XXXVIII.
Test 3.

FIGURE XXXIX.
Test 4.

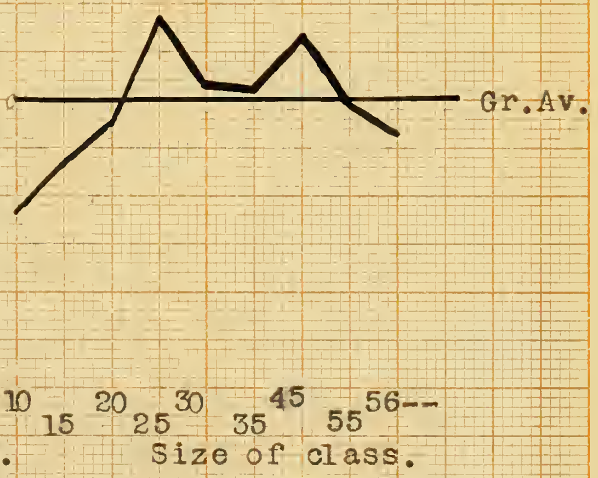
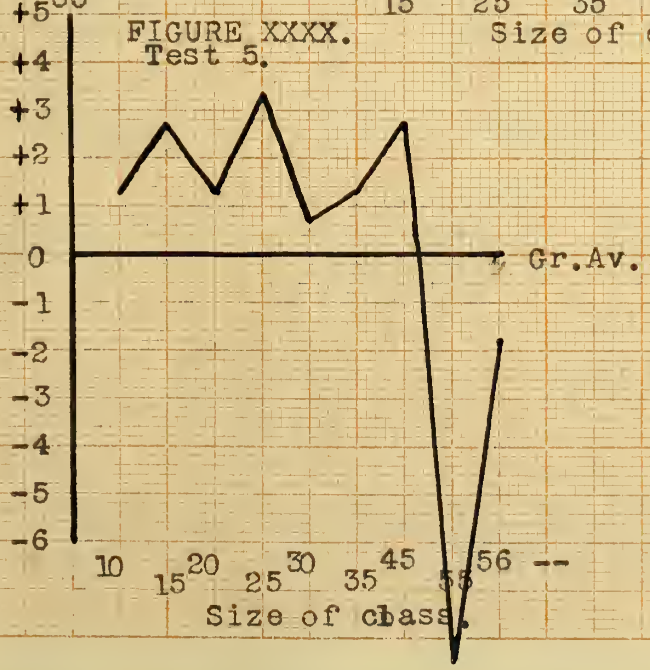


FIGURE XXXX.
Test 5.



Figures at the left represent deviations from grade average, Gr. Av., in these diagrams marked 0.

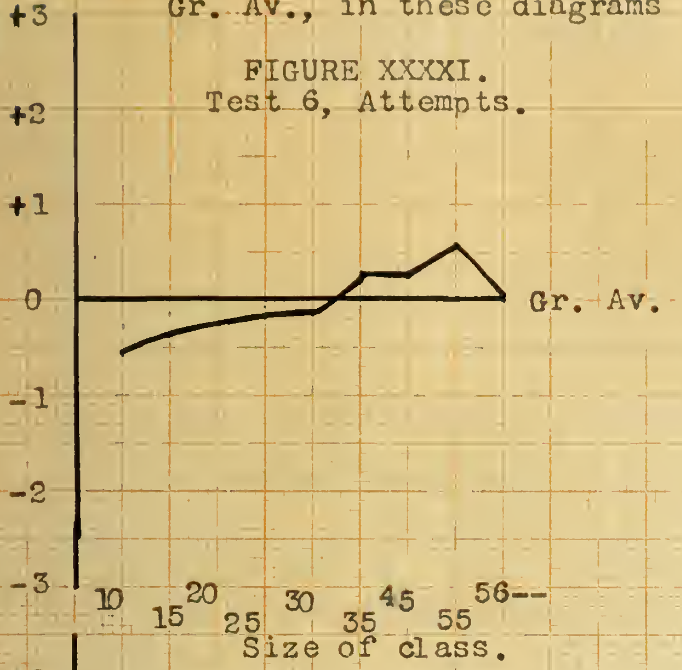


FIGURE XXXXI.
Test 6, Attempts.

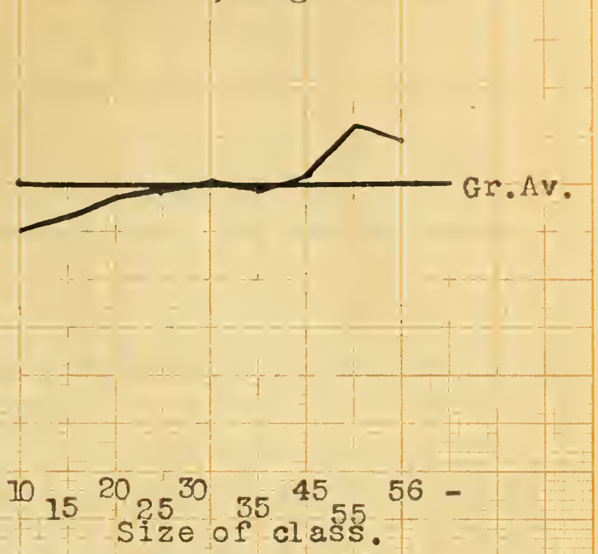


FIGURE XXXXII.
Test 6, Rights.

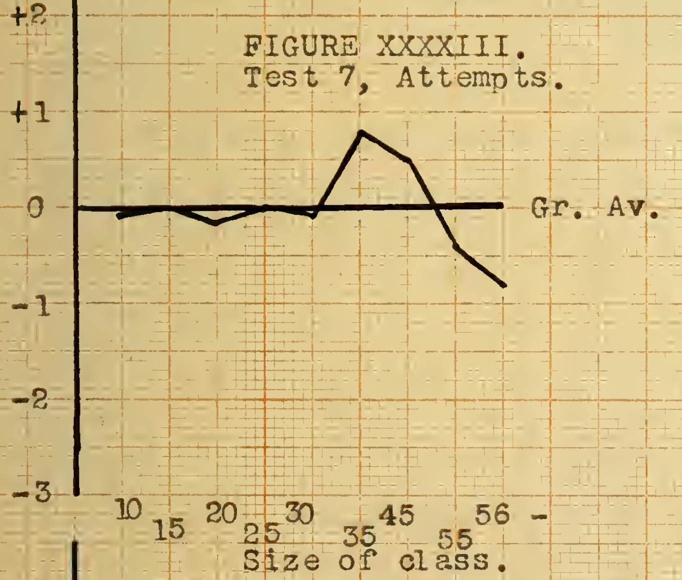


FIGURE XXXXIII.
Test 7, Attempts.

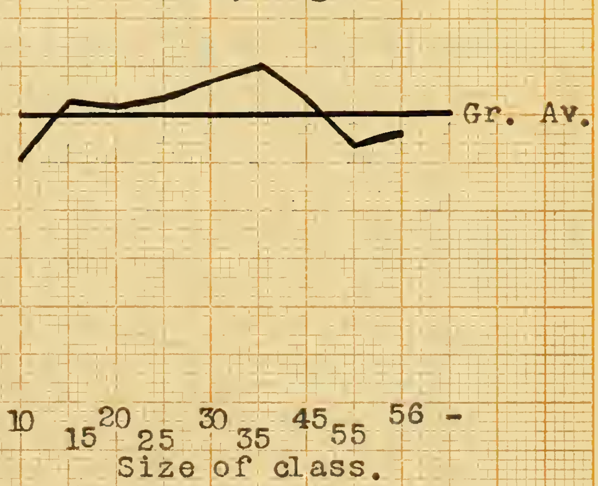


FIGURE XXXXIV.
Test 7, Rights.

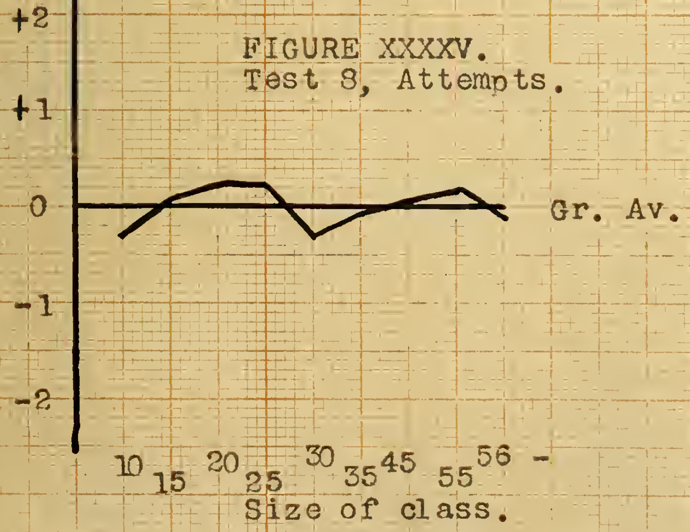


FIGURE XXXXV.
Test 8, Attempts.

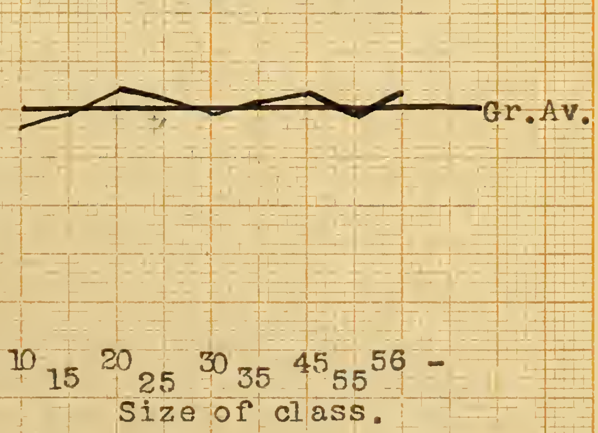


Figure XXXXVI.
Test 8, Rights.

in classes of 35 pupils or more.

Conclusions.

From the facts obtained from Tables XIV, XV, and XVI the following conclusions may be drawn;-

(1) The evidence that small classes do better work in arithmetic than large classes is very slight.

(2) Medium sized classes, however, rank slightly above the average for classes in general with reference to achievement in arithmetic.

(3) Very large and very small classes almost without exception do work below the average for classes in general.

Comments on the Data of Chapters VII, VIII, IX, and X.

The data of Chapters VII,VIII, IX, and X are wholly inadequate as bases for drawing any general conclusions. Lack of time made it impossible for the writer to make a larger number of observations. The results stated in these chapters need to be verified by much more extended investigations. The results are incorporated here, however, in order that investigators in the future may have the use of them. They may be taken as indicative only, and by no means conclusive.

CHAPTER VII.

The relation of the percentage of inattentive pupils during the recitation to the size of the class.

It may be safely assumed that pupils of any class not giving attention to the work of the recitation at least as much as half the time during the recitation period, are not getting the full benefits of the recitation. If there are proportionately more inattentive pupils in large classes than in small classes, then the large classes must be more inefficient. With certain precautions in determining the number of inattentive pupils then, we may use this as a standard for comparing the efficiency of classes of different sizes.

It was assumed that the average superintendent is capable of judging whether a pupil is inattentive to the work of the recitation. By careful observation of all pupils of a class during several recitation periods one can judge rather accurately the number of pupils not attending to work as much as half the time.

Questionnaire blanks, asking for certain data with respect to the size of the class, were sent out to a number of city superintendents. A sample blank is given in FORM II. These were accompanied by specific directions as given in FORM III. Evidently the filling out of the forms was considered too great a task by the superintendents, as only one superintendent responded.

The writer, however, undertook to secure the desired data by making fifty-two observations of the work of twenty-two classes ranging in size from six to forty-two pupils. These data together with those of the one superintendent give a total of 76 observations of the work of 30 classes. As stated on page 45 these data

FORM II.

RELATION OF SIZE OF CLASSES TO SCHOOL-ROOM EFFICIENCY

		GRADES																							
		I			II			III			IV			V			VI			VII			VIII		
		Number of pupils	Hour of day	Subject	Number of pupils	Hour of day	Subject	Number of pupils	Hour of day	Subject	Number of pupils	Hour of day	Subject	Number of pupils	Hour of day	Subject	Number of pupils	Hour of day	Subject	Number of pupils	Hour of day	Subject	Number of pupils	Hour of day	Subject
Number in attendance in class,—																									
NUMBER OF PUPILS IN CLASS,—																									
1. Not giving attention to work of class as much as half the time,	1st visit																								
	2nd visit																								
	3rd visit																								
	4th visit																								
2. Not taking any active part in work of the recitation	1st visit																								
	2nd visit																								
	3rd visit																								
	4th visit																								
3. According to teacher's estimate, who are not doing satisfactory work																									
4. According to teacher's estimate, whose conduct is not satisfactory																									
TIME IN MINUTES AND SECONDS—																									
5. Required for class as a whole to get to work after each intermission	1st visit																								
	2nd visit																								
	3rd visit																								
	4th visit																								
6. Required for class as a whole to get to work after each recitation	1st visit																								
	2nd visit																								
	3rd visit																								
	4th visit																								
7. Required for class as a whole to get to the board or front of room after signal is given	1st visit																								
	2nd visit																								
	3rd visit																								
	4th visit																								
8. Required for class as a whole to get ready for dismissal after signal is given	1st visit																								
	2nd visit																								
	3rd visit																								
	4th visit																								
9. Total time wasted in study class by individuals of class through disorder, inattention, leaving room, etc.	1st visit																								
	2nd visit																								
	3rd visit																								
	4th visit																								
10. Length of study period upon which the observations in item 9 above are based	1st visit																								
	2nd visit																								
	3rd visit																								
	4th visit																								

Superintendent, ... City .... Building ....

(Make any comments you think would be helpful on back of this sheet.)

FORM III.

Directions.

1. Items 1 and 2 are to be determined by counting the number of for the whole recitation period evidently not giving attention and not taking any active part, either voluntarily or when called upon, in the work of the recitation.
2. Items 3 and 4 are to be determined by asking the teacher's judgment on those items at the time of the last visit. (Not used in this investigation.)
3. In the measurement of time for items 5 to 10 a watch, preferably a stop watch, is required. If a stop watch is used fractions of a second may be disregarded. In making record use this form; for one minute and twelve seconds write, 1' 12".
4. The term "class as a whole" as used in items 5, 6, 7, and 8, means every single member of the class, e.g. most of the class get to work after recitation in 12" but one member requires 2' hence the class as a whole is arbitrarily measured by this one person and the time would be two minutes.
5. The record for item 9 is determined by getting the time wasted by each individual and finding the sum for all individuals wasting time.
6. A sample item properly filled out appears thus;-

Number	Hour	Subject
6	2pm	Read.

Number	Hour	Subject.
2	9 am	Spell.

are insufficient for drawing general conclusions but the results may be taken as indicative of the relation which may exist between the size of class and certain phases of classroom efficiency.

Table XVIIshows the number of classes observed, number of pupils in those classes, number of separate observations made, and the percentage of the whole class evidently not attending to the work of the recitation as much as half the recitation time. These percentages were obtained by dividing the number of inattentive pupils by the total number in the class at the time the observation was made. These percentages were then averaged for the classes of each group without reference to the grade of the class. The classes were too few in number to make any division into grades.

TABLE XVII.

(Showing percentage of class attending to work of the class as much as half the recitation time.)

Size of classes.	No. of classes.	No. of pupils.	No. of observations made.	% of class not attending.
10 or less.	1	6	3	0
11 - 15	6	84	15	18.5
16 - 20	10	181	23	27.2
21 - 25	8	183	18	17.8
26 - 30	1	30	5	10.0
31 - 35	2	66	5	18.1
36 - 40	0	0	0	0
41 - 45	2	84	7	21.4
	30	634	76	16.1

The following facts are evident from the above table:-

(1) The largest percentage of pupils not giving attention is in classes of from 16 to 20 pupils; the smallest, in the one class of less than 10 pupils. (2) There is no regular increase in the number of inattentive pupils as the classes become larger.

Although the data are very meager, the results would seem to indicate that the size of the class is not an important factor in determining the number of pupils giving attention to the work of the recitation.

CHAPTER VIII.

Relation of the size of class to the number of pupils taking part in the activities of the recitation.

One of the functions of the recitation is to give to the pupils the opportunity of taking a more or less active part in the discussions, of expressing ideas previously gained, of forming opinions and stating them, and of questioning and being questioned. It is generally believed that pupils who do not take an active part in the work of the recitation do not receive so great benefits from the recitation as those who participate in its activities. A large part of the activities of the class during the recitation period consists in some form of expression by the pupils. If the opportunities for expression and active participation in the discussions are more limited in large classes than in small classes, then we may conclude that the large class is less efficient as a unit for instruction than the small class. It is the problem of this chapter to determine the effect of the size of the class upon the percentage of pupils taking active part in the work of the recitation.

Data obtained at the same time and by the same method as those given in Chapter VI have some bearing on this point. Item 2 of Form II asks for the number of pupils not taking any active part in the work of the recitation. This number divided by the number of pupils in the class at the time of the observations, gives the percentage of the class not actively participating in the work of the recitation. Only those were counted as non-participants who neither responded when called upon nor volunteered to recite, or who neither asked questions nor in any way took part in the acti-

vities of the recitation. Table XVIII summarizes the data secured.

TABLE XVIII.

(Showing percent of class not taking active part in work of the recitation.)

Size of classes.	Number of classes.	Number of pupils.	Number of observations.	% of class not taking part.
10 or less.	1	6	3	0
11 - 15	6	84	15	12.8
16 - 20	10	181	23	17.5
21 - 25	8	183	18	19.1
26 - 30	1	30	5	10.0
31 - 35	2	66	5	16.1
36 - 40	0	0	0	0
41 - 45.	2	84	7	17.5
	30	634	76	13.3

Table XVIII shows, (1) The largest percentage of pupils not participating in the work of the recitation is in classes of from 21 to 25 pupils; the smallest percentage, in classes of 10 pupils or less. (2) There is no regular increase in the percentages of pupils not taking active part in the recitation corresponding to the increase in the size of the class.

These facts give only slight evidence in favor of small classes.

CHAPTER IX.

Relation of the size of class to the time required for a class to perform the various mechanical activities of the classroom.

The ease and promptness with which a class performs the various mechanical activities of the classroom is an index of the efficiency of the management of that class. If the class, in passing to the board or front of the room, moves promptly and without confusion there is evidence of efficient training in the habits pertaining to those movements. If much time is occupied in getting ready for work after intermissions and after recitations or in getting ready for dismissal, there is need of training in the habits which make for promptness and facility in performing those activities. The size of the class may be a factor in determining the ease with which the above named activities can be reduced to the plane of habit. If small classes perform these activities in less time than large classes, we have another, though not weighty argument for the reduction of the size of classes. The table which follows gives some evidence in answer to the question,- Can small classes be more efficiently managed than large classes?

The data of Table XIX were secured during 76 observations in 30 different classes distributed throughout the grades. A watch was held and the time counted from the time the signal was given until the completion of the activity by every member of the class. Some pupils were prompt in their movements while others were slow and dilatory. The class as a whole, however, and not the individuals, was taken as a unit.

The time in Table XIX is given in seconds and represents the average for all classes of a given size. The number of classes, the number of pupils, and the number of observations are the same as in Tables XVII and XVIII.

TABLE XIX.

(Showing time required for classes to perform the various mechanical activities of the classroom.)

Size of classes.	Time to get to work after each intermission.	Time to get to work after each recitation.	Time to get to board or front of room.	Time to get ready for dismissal.
10 or less.	30"	120"	60"	80"
11 - 15	62	78	27	75
16 - 20	92	186	36	97
21 - 25	69	87	38	45
26 - 30	--	66	20	60
31 - 35	24	67	113	61
36 - 40	--	--	--	--
41 - 45.	91	174	38	81
	61	111	47	71

The following facts may be gained from the above table:-

(1) The maximum time required for all activities except that for passing to the board is in classes of from 16 to 20 pupils.

(2) There is no conclusive evidence that large classes uniformly require more time than small classes to perform the routine activities of the classroom.

The evidence of the above facts seems to indicate that the size of the class is not an important factor in efficient classroom management.

CHAPTER X.

Time wasted in classes of different sizes during the study period.

In this chapter we shall attempt to answer the question of whether the number of pupils in a class has any effect upon the amount of time wasted by the class during the study period. If pupils in large classes waste more time than pupils in small classes waste, then the class should be reduced in size. There is no doubt that much of the time in the study class is really wasted because the pupils do not know how to study. Where there are two sections or classes in a room one is expected to study while the other is reciting. Under these conditions the study section cannot be receiving much of the teacher's attention during the study period. Since this is true much time is wasted, which under more careful direction by the teacher, would be profitably employed. The greater the number of pupils in a study class the more difficult is it to keep every pupil employed. If this be true then we should expect to find more time wasted in large than in small classes. Table XX shows that this is not the case in so far as our figures apply.

Time was considered wasted when the pupil was not doing the work that was assigned to be done during the study period, or when he was not employed in some activity which seemed, to the observer, to be profitable. When pupils were engaged in the numerous forms of disorder, or when they appeared to be killing time by engaging in some unnecessary activity, the time thus employed was judged to be wasted. It was evident that some pupils wasted no time while others wasted practically all of the time assigned.

The time was estimated as accurately as possible, watch in hand, for each individual of the class during the observation period. The sum of the minutes thus wasted was then computed. This gave the total time wasted by all individuals of the class. The number of pupils was then multiplied by the number of minutes in the study period. This gave the gave the total possible minutes for study by the whole class. This number was then divided into the total number of minutes wasted, giving the percentage of time wasted. The following formula may make these statements somewhat clearer;-

$$\frac{\text{Sum of minutes wasted by all individuals}}{\text{Length of study period} \times \text{number of pupils in class.}} = \%\text{ of time wasted.}$$

TABLE XX.

(Showing percentage of time wasted in study classes of different sizes.)

Size of classes.	Number of classes.	Number of pupils.	Number of observations.	% of time wasted.
10 or less.	1	6	3	41.7
11 - 15	6	84	15	19.8
16 - 20	10	181	23	40.4
21 - 25	8	183	18	13.2
26 - 30	1	30	5	1.6
31 - 35	2	66	5	2.2
36 - 40	0	0	0	0
41 - 45.	2	84	7	13.1
	30	634	76	18.8

Although the data of the above table are inadequate for conclusive proof the results would seem to indicate the following facts; - (1) The largest percentage of time is wasted in classes of 10 pupils or less. (2) The smallest percentages of time wasted are in classes enrolling from 26 to 35 pupils. (3) Small classes seem to waste slightly more time than the large classes.

The facts of Table XX are in no sense to be taken as generalizations. The same is also true of the facts gained from Tables XVII, XVIII, and XIX. The facts indicated in these tables might easily be disproved if drawn from twice or thrice the data now at hand. It is much to be regretted that more data were not available at the present time.

CHAPTER XI.

Summary and Conclusions.

It will be recalled that the following were used as measures of classroom efficiency in making this investigation:-

(1) Promotion rate.

(2) Percentage of withdrawals.

(3) Achievement in arithmetic as measured by the Courtis Tests.

(4) The percentage of the class not giving attention during the recitation period.

(5) The percentage of pupils not taking active part in the work of the recitation.

(6) Time spent in performing the various routine activities of the classroom.

(7) Time wasted in the study class.

All of the above measures were applied with reference to the size of the class. The data secured from an application of the last four of these measures are not adequate for drawing any general conclusions, but the results may be regarded as at least indicative of the facts.

In applying each of the measures certain incidental facts as well as facts pertinent to the problem in hand, were disclosed. These can best be summarized under separate headings.

Promotion Rate.

(1) The median sized class is a class of 23 pupils.

(2) The median number of pupils is enrolled in a class of 28 pupils.

(3) The maximum promotion rate is found in classes of 30 pupils or less.

(4) There is apparently a slight direct relationship between the size of the class and the promotion rate. This relationship is sufficient to produce an increase in the number of promotions per thousand of from 5 to 39 pupils over what it is at present, provided all large classes could be reduced to small classes.

(5) The effect of the size of class on the promotion rate, though slight, is in favor of small classes.

(6) Apparently large classes are not more productive of low promotion rates in the Primary than in the Grammar Grades.

(7) The highest promotion rate in rooms enrolling 35 pupils or less.

(8) A reduction of the room-enrollment to 35 pupils or less would probably result in a gain in promotions of 50 pupils per thousand.

(9) The highest promotion rate is found in rooms where there is no grouping of pupils into separate classes or sections.

(10) Rooms enrolling pupils of one grade only have a slightly higher promotion rate than rooms enrolling pupils of two or more grades.

Percentage of Withdrawals.

(1) The larger the class the higher is the percentage of withdrawals.

(2) In classes of more than 35 pupils the percentage of withdrawals is greater by 4% than in classes of 35 pupils or less.

Achievement in Arithmetic.

(1) One-half of all the maximum scores made in the eight tests of the Courtis Series are made by classes of 35 pupils or less. Nearly one-fourth of all maximum scores are made by classes with an enrollment of from 36 to 45 pupils.

(2) Very large and very small classes make lower scores than are made by classes in general.

(3) Medium sized classes (30 to 45 pupils) do the best work in arithmetic.

Other Measures.

Insufficient data concerning these measures make any general conclusions untrustworthy. Yet on the basis of the data at hand the following facts would aeem to be indicated:-

(1) The size of the class is not a factor in determining the number of pupils giving attention to the work of the recitation.

(2) In the matter of offering opportunities to pupils to participate in the activities of the recitation, the evidence though slight, is in favor of small classes.

(3) The size of the class does not seem to be an important factor in securing efficient classroom management.

(4) Classes of from 26 to 35 pupils seem to waste less time during the study period than classes of any other size.

Conclusions.

The conclusions stated herewith are in substantial accord with those reached by earlier investigators although there are some slight disagreements as to details. Those phases of the problem which have not been studied by earlier investigators, are found to corroborate the findings of the earlier studies.in regard to the fundamental points of the problem.

(1) The effect of the size of the class on the promotion rate though slight, is in favor of classes of thirty pupils or less.

(2) The relationship between the number of pupils in a room and the promotion rate is more marked than between the size of class and the promotion rate. Rooms with an enrollment of 35 pupils or less have the highest promotion rates.

(3) The presence of more than one class or section in a room tends to lower the promotion rate below that of rooms containing only one section.

(4) A slightly higher promotion rate is found in rooms where the pupils are of one grade and not of mixed grades.

(5) Large classes seem to be a factor in producing withdrawals from the class. This is no doubt due to the relationship which which exists between non-promotion and elimination.

(6) Medium sized classes(30 to 45 pupils) seem to do better work in arithmetic than either very large or very small classes.

(7) The opportunity for pupils to participate in the work of

the recitation is somewhat more limited in large than in small classes.

(8) In the results obtained from the data at hand the efficiency of large classes over that of small classes is not apparent when measured by the attention given during the recitation, by the time spent in the routine activities, and by the time wasted in the study period.

(9) The optimum grouping of pupils is probably as follows:- A single class of not over thirty-five pupils of one grade in a single room under one teacher.